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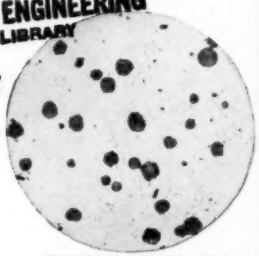

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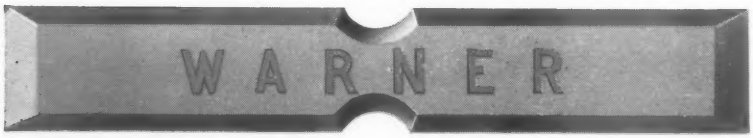

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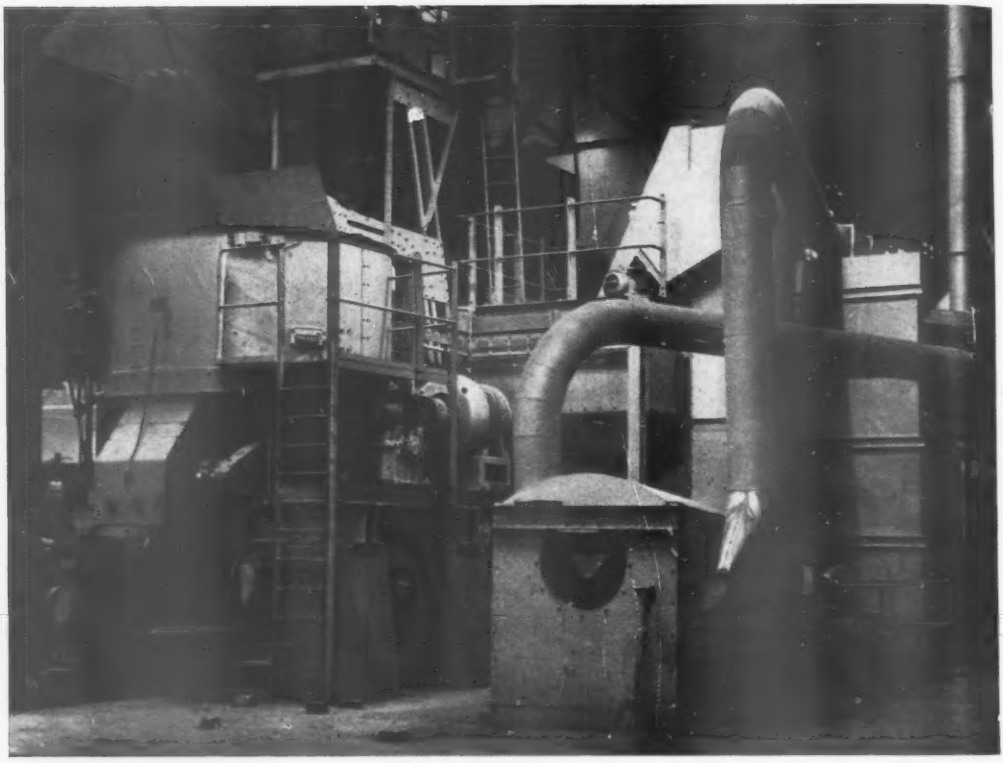

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Census of Distribution

Generally speaking, the census of production which the Board of Trade carries out periodically is not popular with industry on the dual grounds of the work it entails for the completion of the forms and the delay between the time of taking the census and its publication. The recently issued "Census of Distribution and Other Services"* certainly suffers from delay in publication, as the statistics reported are for the year 1950. Their major interest to the manufacturer is in respect of the cost to him of the services rendered by the wholesaler. In the Report the costs are shown to vary from three to 33.4 per cent., the latter figure being for dealers in second-hand machinery, who naturally have much work to do on reconditioning and also have to envisage prolonged storage. The average profit for the wholesaler is 12.8 per cent. and that of the builders' merchants somewhere between 19 and 20 per cent.

Naturally, the wise manufacturer will ask whether he could or could not carry out the services performed by the merchant more cheaply and efficiently himself. In most cases where we have had the opportunity to discuss such matters with the manufacturers, we have been told that, where the consumers are small and widely diffused, it is cheaper to entrust sales to the wholesaler, despite the fact that to-day the manufacturer has to carry much of the cost of selling himself. This cost includes national and local advertising, district offices, some servicing and travelling expenses. Thus, the total selling expenses are very much in excess of the figures quoted in the Report.

That manufacturers have seriously considered entering the wholesale and indeed the retail trade is shown by the fact that manufacturers' wholesale organizations sold £303-million worth of goods in 1950, whilst the wholesalers handled something of the order of £1,670-million. How a firm sells is governed to a large extent by its customers and in the classification of sales of the foundry industry, much is shown to go to the nationalized industries—railways, mines, electricity and gas undertakings. Municipal authorities, too, are very important, leaving the builders' and hardware merchants; the iron and steel industry and engineering trades as the largest private consumers. Thus, this stupendous Report can only interest a small section of the foundry industry and then merely disclose what happened five years ago. However, the cost of the marketing of castings is an all important subject and if this Report does focus attention upon it, the enormous task of its compilation may have been worthwhile.

* Published by HM Stationery Office; price 15s. net.

WILLIAM RENNIE, J.P.

Chairman and Managing Director of Federated Foundries, Limited

Leaders of the Industry

WILLIAM RENNIE, J.P.

WILLIAM RENNIE, whose portrait is reproduced on the facing page, is chairman and managing director of Federated Foundries, Limited, Possilpark, Glasgow, one of the larger groups of foundries manufacturing light castings for the building trades. He has held this position since 1935, the year in which Federated Foundries, Limited, was formed.

On leaving school in Glasgow, Mr. Rennie started work in the drawing office of David King & Sons, Possilpark, and received his business training under the strict guidance of his uncle, the late Baillie John King, who was then the principal partner. Mr. Rennie studied at the Glasgow Technical College and at the Glasgow School of Art and completed his apprenticeship as a draughtsman. In his early years, Mr. Rennie had the advantage of practical experience, not only in all the principal departments in the foundry but also on the road as a salesman. In 1924, he was appointed a director and later became chairman of David King & Sons, Limited.

It was principally owing to his efforts that Federated Foundries, Limited, was formed in 1935 to take control of a group of twelve foundries in Scotland and England. The progressive development of production methods and mechanization in these foundries has been carried out under Mr. Rennie's guidance and it was due to his stimulating thought and interest that at one of the works the recent revolutionary method of producing cast-iron gutters was perfected.

Throughout his business career, Mr. Rennie has been keenly interested in the welfare of the employees and has devoted much of his time to the affairs of the National Light Castings Ironfounders' Federation in which his wise counsel was and is highly respected. For the past 24 years he has been a member of the executive committee of the British Ironfounders' Association. He was a vice-president of the British Coal Utilization Research Association and is a member of the development committee of the Scottish Council (Development and Industry), and member of the Scottish committee of the Council of Industrial Design.

IVE Annual Conference and International Congress

The twenty-first annual conference of the Institute of Vitreous Enamellers will be held in conjunction with an international congress. The draft programme is that a pre-conference tour of enamelling works will commence in London on Saturday, October 8, and terminate in Leamington on October 11. During this time, the following companies have agreed to receive parties:—Belling & Company, Limited; R. & A. Main, Limited; Electrolux, Limited, and Benjamin Electric Company, Limited.

The party will arrive in Leamington on Tuesday, October 11, and remain there until Sunday, October 16. For this period the programme will consist mainly of technical sessions and the following papers have already been offered and accepted. "Modern Developments in De-enamelling"; "Enamelling Practices in Denmark"; "Porcelain Enamel in Building Construction"; "Development of Opacity in White Porcelain Enamel"; "Pickling prior to Enamelling"; "Viscosity of Frits"; "Coefficient of Thermal Expansion of Frits"; "Heat-resisting Enamels"; "Methods of Grading Quality with Special Reference to Bath Tubs"; "Modern Developments in the Screen Process"; a paper on investigations on hydrogen permeability and electrolytic test for fish-scaling resistance, and "Sheet Iron Vitreous Enamelling in Australia." There will also be a paper from Germany and possibly one from Sweden, Belgium, Switzerland and Italy.

21st Anniversary

As this will be the 21st anniversary of the formation of the Institute, a paper on its work over the years is being prepared by Mr. V. C. Faulkner in collaboration with other founder members of the Institute.

Also during the stay in Leamington, special works visits will be arranged to the following companies: Parkinson Stove Company, Limited, and Thomas De La Rue & Company, Limited. On Sunday, October 16, delegates will leave Leamington Spa for a post-conference tour, visiting Lancashire and Yorkshire, during which visits will be made to: Blake Vitreous Enamelling Limited, English Electric Company, Limited, Richmonds Gas Stove Company, Limited, and Stoves, Limited.

Extension

It was originally intended that the Congress should end on Thursday, October 20, but at a recent Council meeting it was agreed that investigations should be made into the possibility of extending the tour to include Edinburgh, in order that visits could be made to some of the Scottish enamelling plants. Full details of this extended tour will be announced at a later date. Throughout the whole congress, social functions will be arranged for delegates and their lady guests.

Overseas members interested in this programme are asked to communicate with the secretary, Mr. J. D. Gardom so that arrangements can be made for their hotel accommodation. It must be stressed that hotel reservations cannot be made for home members through the Institute's offices.

IT WAS REPORTED at a recent meeting of the Council of the Institute of Vitreous Enamellers that it was hoped in the near future to form a Scottish section. Readers interested in receiving details in due course should write to the general secretary, Mr. J. D. Gardom, John Gardom & Company, Ripley, Derbyshire.

Notes from the Branches

Sheffield

The annual dinner of the Sheffield branch of the Institute of British Foundrymen was held at the Royal Victoria Hotel on January 24. Mr. E. Ayres presided over a company of about 350 members and guests. Accompanying him at the top table were Mr. A. Graham Stewart; Mr. John Bell; the Lord Mayor of Sheffield, Alderman J. H. Bingham, LLD, JP; the Master Cutler; Lord Dudley Gordon; the Right Reverend, the Lord Bishop of Sheffield (Dr. Hunter); Sir Frederick Stopes; Mr. V. C. Faulkner; Mr. Ambrose Firth; Mr. R. C. Heys; Mr. F. A. Hurst; Mr. H. E. Jackson; Mr. G. Llewellyn Jones (general manager, *Sheffield Telegraph and Star*); Mr. G. Lambert; Mr. F. N. Lloyd; Mr. A. F. Rayner; and Mr. H. Secker.

During the course of the dinner the chairman, Mr. Ayres, announced the receipt of a telegram from the Duke of Edinburgh which read:—

"Please thank the president and members of the Sheffield branch of the Institute of British Foundrymen for their kind message and greeting on the occasion of their annual dinner.

"I am very pleased to be associated with the Institute by honorary membership. May I wish all those dining to-night a very pleasant evening."

(signed) "PHILIP."

Proposing the toast to the city, Mr. John Bell pointed out that although Sheffield produced only "one fifteenth of the total steel output of the country the city's production was worth as much as the whole of the remainder." In replying, the Lord Mayor thanked the members for their gift of a basket of fruit for the Lady Mayoress, who was at the moment in a convalescent home. Mr. R. F. Horton, the branch senior vice-president, very charmingly proposed "The Guests." Mr. Graham Stewart, the chairman of Stewarts and Lloyds, Limited, replied and foresaw an unlimited demand for iron and steel in the future. An orchestra under the direction of Hal Baker played throughout the dinner, which was admirably organized by Mr. J. Pearce.

Birmingham

Lieut.-Col. K. Reavell, of Ipswich, said at the annual dinner of the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen in Birmingham on January 21, that bodies such as the Institute were helping the progress of British industries. "I do appreciate the specialist," he said. "We all have our difficulties in certain lines and we want the specialist to solve them for us." Col. Reavell, who was proposing a toast to the Institute and the local branch, said that ironfounders had enabled Britain to maintain her exports.

Replying, Mr. J. L. Francis, president of the branch, said that the first 50 years of the Institute, which had recently been celebrated, had been marked by steady progress. The toast to the Guests was proposed by Mr. H. G. Hall, and responded to by Mr. John Bell, the national president.

Latest Foundry Statistics

According to the British Iron and Steel Federation, the steel foundries on November 6 were employing 19,704 people, an increase of 112 over the previous month. The production of steel castings during October, expressed as a weekly average, was 5,800 tons as against 5,900 tons in September.

Close-tolerance Castings*

It is true that the features and limitations of each method of casting to close tolerances are directly dependent on the design of each part and therefore rules cannot be laid down which will hold true for all the processes. There are, however, certain characteristics of each process which make it more suitable for casting certain types of parts. And though there may be many areas where they overlap and are highly competitive, each of them definitely fills a certain need in the metal forming field. It is the purpose of this article to delineate these areas as clearly as possible in order to narrow the field of selection for the engineer.

Six basic processes are covered here: (1) investment casting; (2) plaster mould; (3) die-casting; (4) pressure die-casting; (5) shell moulding; and (6) some specialized sand-casting techniques. These six basic processes allow a wide range of materials, shapes, sizes and characteristics for commercial production of close-tolerance castings.

In each section covering a specific kind of close-tolerance casting, the process is described briefly and the limitations and advantages discussed. Some foundries have had occasion to work to closer tolerances than others. In these cases, examples are given and extreme cases mentioned. A case history with each process illustrates the type of part which particularly lends itself to that casting method.

There are several reasons for investigating close-tolerance casting, and they all boil down to cost. There are some parts with areas which could not be machined if formed in one piece. Such parts must usually be made in several pieces, machined and assembled. By using a suitable casting method, it may well be that the part could be cast in one piece, maintaining the surface finish and dimensional accuracy in critical areas in the as-cast condition. By producing the part as a casting, machining and assembly costs can be reduced. In addition, duplicate fabricating and assembly equipment can be eliminated. Where a part is presently being formed in one piece but heavy machining and finishing is necessary to produce required accuracy, close-tolerance casting may substantially reduce machining to the point where only a minor finishing operation is necessary.

Another point to be considered is the higher material yield obtained when machining is reduced. This can be a determining factor when coupled with the reduction in machining time. In general, more machining means more scrap and a higher materials cost per part.

Implications of Precision

It should be realized that casting metals to dimensional tolerances of ±0.001 to 0.005 in. is highly specialized work requiring close control over the variables encountered in foundrywork, such as patternmaking, mould or die making, composition of the alloys, cleanliness of the alloys, melting techniques, etc. This generally will raise the cost of the casting process itself. The comparison, then, between parts made with one of these processes and another method should be made on the basis of the end cost of the finished part. If the cost of the casting represents an increase in the primary cost of the part, it may well be over-balanced by the reduction in supplementary operations. This can result in a substantial reduction in the over-all cost of the finished part.

It is easy to oversell close-tolerance casting processes. They are capable of some extraordinary results, particularly when working in the laboratory or in pilot quantities. The engineer who is selecting a method of producing a part is not interested in what can be done under the controlled conditions of the laboratory. He wants to know what can be done on the foundry floor, under commercial production conditions. None of these processes is a panacea. There are very few cases where close-tolerance casting will eliminate all secondary machining operations if extremely high accuracy is required. In most cases, machining will be reduced to a point where it is merely a finishing operation, but no casting process can replace machining to attain greatest accuracy. It is all a matter of degree.

What is a Close-tolerance Casting?

If an engineer in a sand casting foundry were asked what he considered to be close tolerances, he might mention any figure from $\frac{1}{16}$ or $\frac{1}{32}$ in. upwards. If a machinist were asked what he considered to be close tolerances, he might mention any figure in the range of 0.0003 to 0.0005 in. Tolerances are all relative to the type of material forming process and the size and shape of the part under consideration. For purposes of this article, the term "close-tolerance casting" has been coined to mean castings where the as-cast dimensions on restricted areas can be held to tolerances in the range of ± 0.001 to 0.005 in. per in., or ±0.010 to 0.020 in. on over-all dimensions.

It should be borne in mind that when a foundry specifies that commercial tolerances in this range can be held, this should not be taken as a guarantee that *all* dimensions of any part can be held to these limits. It merely means that if the part lends itself to that particular casting method, and if designed properly, dimensions on certain critical areas of the part may be held to these tolerances. Actual commercial tolerances possible on any dimension

* Extracted from a survey made by the Editorial staff of *Materials & Methods*.

Close-tolerance Castings

of a part can be accurately predicted only after consultation with the engineers in the foundry.

How to Select the Casting

In the final analysis, no one can lay down definite rules to follow in selecting one of the six major types of close-tolerance casting. Some are so new that their limitations have not been fully explored, and foundrymen themselves do not know exactly what parts can be produced until they look over the specifications. There are, however, certain factors peculiar to each process which definitely limit it to the production of certain types of castings. After this first step of eliminating those methods which cannot be considered, the only way to determine the most economical one is to consult the engineer in the foundry. He can determine whether the part lends itself to that process, and can aid in designing the part for most economical production.

Factors which must be considered in selecting a process include the design of the part; its shape and complexity; the size of the part and what areas must be held to mandatory tolerances; the material of which the part must be made (since some of the processes are limited to certain types of alloys); the surface finish necessary, and in what areas it must be maintained; the structural properties necessary in the resultant part; and the production quantity necessary, since a large factor in the economics of manufacturing a part depend on this item.

General Metallurgical Considerations

Shrinkage.—Shrinkage of molten metal as it freezes is a prime consideration in holding accurate dimensions of castings. In normal sand-casting operations, shrink rules may be used by foundries for each alloy. However, since shrinkage in a casting can alter a dimension anything from 0 to 0.025 in. or more, it assumes major importance when holding tolerances in the range of ±0.005 to 0.010 in., and general rules cannot be applied.

The degree to which a solidifying metal will shrink differs with each alloy used and the temperature at which it is poured. The degree and method in which the shrinkage will affect the dimensions of a casting depends on the design of the part, *i.e.*, the amount of metal and the shape in which it is poured. These problems are not dealt with in this article due to their dependence on individual design. They are essentially the problem of the engineer in the foundry. However, it should be realized that the degree of accuracy of the casting depends to a large extent on the ability to calculate this shrinkage. This problem is compounded by the considerations of expansion and contraction of patterns and moulds as well as that of the casting alloy. In investment casting, for instance, when using wax patterns the engineer must consider the expansion of the pattern mould while pouring the wax, shrinkage of the wax pattern as it cools, the shrinkage of the mould as it is baked, and the shrinkage of the molten metal as it solidifies. All these are variables which may affect the accuracy of the part, and the ability accurately to estimate and allow for all these variables is the measure of a good foundryman.

Solidification—The study of the mechanism of solidification of molten metals is a science, and there are still some unknowns under investigation. However, certain general rules aid in understanding the characteristics of castings produced by various methods. Maximum control over solidification of

TABLE I.—*General Characteristics of Close-tolerance Castings.*

Casting type	Choice of materials.[1]	Tolerances, in. per in.		Cost factors.		
		Normal.	Possible on 1-in. dimen.	Labour.	Equipment (dies, patterns, and/or machines).	Casting materials.
Precision sand casting	(4)—Aluminium magnesium and bronze alloys. Use of ferrous uncertain as to dimensional accuracy.	± 0.005 ..	± 0.003 ..	Medium high	Low ..	High ..
Shell moulding ..	(1)—Any castable alloys, though mostly ferrous being cast.	± 0.005 ± 0.010 across parting line	± 0.003	Low ..	Medium high	Wide range
Plaster mould ..	(5)—Aluminium, magnesium and some copper-base alloys. (Melting point below around 1,000 deg. C.	± 0.005 ± 0.010 across parting line	± 0.005	Medium high	Low ..	High ..
Gravity-die ..	(3)—Aluminium, magnesium and copper-base	0.015 in. overall on small dimensions.	± 0.005	Medium	High ..	High, nonferous; low, grey iron
Pressure die-casting	(5)—Aluminium, magnesium zinc, some copper-base alloys, tin and lead.	± 0.005 ± 0.010 across parting line	± 0.002-Zn ± 0.003-Al	Low ..	High ..	High ..
Investment ..	(2)—Any castable alloy.	± 0.005	± 0.003	High ..	Varies with quality of pattern die necessary.	Wide range

Notes: 1. Numbers represent relative range of choice in selection of materials (1) = widest choice (2) = narrower choice, etc.

a casting is the ideal to be sought in each of the processes. Speed and direction of solidification contribute to the resultant properties of the casting and also are vital to the problem of proper feeding of all the areas. Optimum design conditions for casting are generally found when thin, finely retailed areas are farther away from the point of entry of the metal, so they can solidify first, and freezing of the metal will progress back toward the sprue through progressively heavier sections. Where the shape of the part will only allow feeding a heavier section through a thinner section, care must be taken not to allow the metal in the thinner section to freeze and shut off the flow of metal to the heavier section before it is completely filled. Control over feeding and solidification is implemented by the foundryman by the designing of proper gates, risers and vents as well as through the use of chills, cooling water, mould washes and the application of heat to certain areas of the moulds.

The various types of mould materials used in the close-tolerance casting methods play a large part in solidification characteristics of the castings. Mould materials with a higher degree of thermal conductivity, *e.g.*, iron or steel, will remove heat from the molten metal more rapidly and produce a chilling effect on the metal. Rapid cooling will generally result in a finer grain structure and better physical properties. Mould materials with a lesser degree of thermal conductivity, *e.g.*, sand or plaster, will act with more of an insulating effect and hold the heat in, slowing solidification of the metal. This will tend to produce larger grain structure, though the slower cooling over a larger mass of metal may result in greater consistency in metallurgical structure. The problem then is one of design and heat control. The mould temperature and material, ideally, should be such that the metal solidifies fast enough to provide a fine-grain structure, yet slow enough so that there will not be a chilled surface with hot spots of molten metal in the interior which may cause internal shrinkage defects in the casting.

TABLE I (*continued*)

Typical rate of production pouring.[2]	Getting into production (from completed design to production).	Size range.	Average size of competitive castings, lb.	Min. sect. thickness, in.	As-cast finish, obtainable in limited areas, rms.	Remarks.
300 per mo.	4–6 wks.	Max. size not known. Present production runs from under 1 lb. to parts 6 ft. in length.	1–4	0.050	75–80	Relatively new refinements in techniques. Limitations not fully explored.
60 per hr.	4–6 wks.	½ to 800 lb. ..	20–30	0.070	60	Process in infancy. Size only limited by size of mould-making machine.
4–5 per hr.	4–6 wks.	Under 1 oz. to over 100 lb.	3 to 5	0.040–0.060	50	May be used in conjunction with sands and gravity die-castings.
30 per hr.	6–12 wks.	1 oz. to 600 lb.	1 to 10	0.090	100–125	Grey iron may be cast, but not with the same degree of accuracy.
75–150 in Al, Mg, Cu-base 300–350 in Zn	8–14 wks.	Under 1 oz. to 75 lb. in Al Under 1 oz. to 200 lb. in Zn	½ to 1	0.050	50	—
Generally low. Higher with plastic pattern.	4–6 wks.	Under 1 oz. to 25 lb. in wax or plastic and over 100 lb. in frozen mercury.	Up to 1	0.030	60 wax and plastic 40 mercury	Frozen - mercury process is relatively new. Full possibilities have not been explored.

2. These figures are general for one set of equipment. Actual rate of casting production would depend on number of cavities per mould.

General Rules

As a general rule, the alloys used for casting will not greatly affect dimensional accuracy of a part, but may have an effect on the ease of obtaining this accuracy. In most of the processes, some degree of control can be held over the speed of solidification. Where a sluggish metal is used, its freezing can be delayed until the finer detail is filled out.

The only generalization that can be made about the relative fluidity of molten metals is that the ferrous are usually more sluggish than the non-ferrous. The addition of silicon or nickel will generally increase the fluidity as demonstrated by the fact that many popular aluminium die-casting alloys have silicon added to them.

Plastic Moulds.—This process is limited to alloys with a casting temperature of 1,000 deg. C. and less. The mechanical properties of the resulting castings are slightly lower owing to the slower cooling. Tolerances are of the order of ±0.005 in. overall, but across the parting line ±0.010 in. should be allowed. The minimum size of cored hole is about ¼ in. dia.

Gravity-die-castings. — With this process, the normal tolerance is about ±0.015 in. overall, on small parts, with an additional 0.010 in. on the parting line. The mould wash, if not carefully applied, can affect the dimensions. In America it is said that 70 to 80 per cent. of all gravity-die-castings weigh from $\frac{1}{16}$ to 10 lb. Holes may be cored down to $\frac{1}{8}$ in. dia.

Pressure-die-castings. — This process will yield tolerances of the order of ±0.003 in. for dimensions up to 1 in. for zinc-base; ±0.004 in. for aluminium and magnesium and ±0.007 in.

Close-tolerance Castings

for copper-base alloys. For dimensions over 12 in., ±0.001 in. per in. tolerances are held in zinc, aluminium, and magnesium, alloys—copper-base alloys do not usually attain these sizes. Holes may be cored down to $\frac{1}{16}$ dia.

Shell-moulded Castings—For this process it is claimed that tolerances may be on inch dimensions within ± 0.003 to ± 0.005 in, and, exceptionally, ± 0.002 in. It is recorded that in one case an over-all tolerance on an 11-in. dimension was held to ± 0.010. Where dimensions fall across a parting line, tolerances should be doubled or at least 0.010 in. should be allowed. Draft angles are less critical than in some other processes and ½ deg. is usually sufficient. It is reported that one foundry has successfully cast an alloy-steel section 8 by 60 in. to a $\frac{1}{16}$ in. thickness. The smallest hole that can be cored is around ½-in. dia.; smaller holes can be cast by forming a nipple in the shell in preference to coring. The as-cast finish is one of the advantages of the process.

Investment Castings—The technical advantages of using frozen-mercury patterns are stressed, but the method is expensive. Tolerances of the order of ± 0.003 to 0.005 in. are obtainable, but the closer the tolerance the higher the cost. No draft is necessary. A preference is shown for a minimum section thickness of 0.080 to 0.090 in.

Special Sand Castings—Though a sand casting is not normally regarded as a close-tolerance cast form, several foundries have set up operations to cast in sand to a higher degree of accuracy than is normally expected with this process. The higher accuracy is attributable to foundry techniques and closer control over the variables rather than a change in process. Carefully-constructed baked sand cores are used in areas where this accuracy is specified, while normal green-sand moulds are used elsewhere. This offers the obvious advantage of limiting the increased cost due to greater accuracy to those areas where it is necessary.

Materials and Properties

At present, most of this type of sand casting is being done in aluminium and magnesium alloys and the phosphor- and tin-bearing bronzes. However, the use of sand castings for close-tolerance work is relatively new and its possibilities and limitations have not been fully explored. The as-cast mechanical properties of the castings are approximately the same as those found in conventional sand castings. They may be slightly higher due to the closer control exercised over all the foundry operations.

Design Factors

Tolerances—Since no applicable standards have been established in this field as yet, tolerances which have been held on commercial castings will indicate the degree of accuracy obtainable. On linear dimensions up to 1½ in. ± 0.003 in., up to 3 in. ± 0.005 in., and up to 7 in. ± 0.010 in. over-all tolerances have been held.

Size and Shape—Castings have been produced by this technique ranging in size from 1 in. to 6 ft. in length. Since the high degree of accuracy requires the use of baked sand cores, it is difficult to say just what limits may be set for maximum practical size of accurate cores.

The limitations on complexity of shape are approximately the same as those for conventional sand castings. It should be pointed out again that the maximum accuracy must be on internal areas where the cores are located. The process is well suited to shapes such as electronic wave guides, where the exterior areas may not be critical, but a high degree of dimensional accuracy and surface smoothness is required on the interior areas.

Other Considerations—Holes as small as ½ in. dia. have been cored successfully and on small plane areas wall thicknesses of 0.050 in. have been held. The as-cast surface finish may range from 75 to 100 rms.

Some Cost Factors

The only practical way of determining what a close-tolerance casting can do in reducing the cost of a product is to compare the end cost of the finished part. The cost of the casting process itself may often be more than the forming method used previously. However, many times this increased cost will be more than offset by a reduction in the cost of subsequent operations. In cases where these costs approach a balance the dividend resulting from a reduction in scrap loss can be a deciding factor. An ideal case might couple the economies of a high production operation with a reduction in subsequent machining and a low loss in scrap material to provide an outstanding reduction in over-all manufacturing cost. Under more typical conditions, the balance may be more delicate.

Engineers working with difficult-to-machine materials should be particularly attracted to close-tolerance casting. When dealing with these materials, machining may make up a large part of the total cost of producing a part, and a reduction in this operation will mean a substantial reduction in the end cost of a product.

Though in some cases, parts may be cast to such accuracy that subsequent finishing is negligible, this will not always be the case, and should not be expected. It will depend on the specifications of the part. Castings cannot attain the accuracy obtainable with machining. However, in most cases, rough-cut machining can be eliminated, and finishing operations reduced to a minimum.

Production

The economies of producing a part depend to a great extent on the production quantities and speed. The production-rate figures given in Table I are general and refer to the rate of filling one mould or die. Each of the processes discussed here can utilize multiple-cavity dies or moulds. When these are used, the rate at which a mould or die is filled must be multiplied by the number of cavities to determine the actual rate of production of castings. The number of cavities per mould or die will

depend on the size and shape of the part. This is one of the reasons that these casting methods lend themselves well to the production of small parts. In some cases, the requirements for feeding certain shapes may also limit the number of cavities which can be incorporated in a mould or die.

Tools or Dies

Generally speaking, the higher the cost of the tools and dies, the larger must be the production quantity to minimize the cost per casting. Tooling costs for gravity- and pressure-die-casting fall in the high cost group, and these are usually justified by a relatively large production quantity. Tooling for shell moulding is lower, and that for investment, plaster mould and sand casting is lower still, which generally corresponds to production requirements for these processes. In some cases, the intrinsic characteristics of the design of the part is the governing factor, and immediate cost may be disregarded in favour of long range cost and practicality of production.

In some cases, the design of a part cannot be "frozen" as it leaves the drawing board, but may require functional testing and modification. If such a part is to be produced by gravity or pressure-die-casting where the tooling costs are high, it might be wise to utilize the flexibility of investment or plaster mould casting to produce pilot quantities for testing and development before going to the expense of manufacturing a production mould or die.

When using any of the six processes, it should be remembered that the resultant castings will be only as good as the tools from which they are made. A good casting cannot be made from a poor mould or die. Where higher degrees of accuracy are required in the casting, higher degrees of accuracy are necessary in the original tooling. This costs money. There are areas on a great many parts where the normal accuracy of the process will suffice, and specifying a greater degree will only incur an unnecessary cost. By specifying accurately the critical dimensions and working out the design of the part with the foundryman, the use of a close-tolerance casting can result in a substantial reduction in the manufacturing cost of a product.

Book Reviews

Metallurgy of the Non-Ferrous Metals, by W. H. Dennis. Published by Sir Isaac Pitman & Sons Limited, Parker Street, Kingsway, London, W.C.2; price, 70s. net.

There is a need for a British text-book on the extraction metallurgy of the non-ferrous metals, as the existing ones are getting rather old. The present work appears at a time when considerable developments are taking place in connection with some metals, and therefore it is difficult to remain up-to-date for very long. There are eighteen pages on uranium and nine on titanium, but more published information is already available on these two important elements and on other rarer metals. Obsolete methods have for the most part been omitted by the author so that there is only a glance at the old Welsh process for copper, whilst flash smelting operations are outlined, vertical-retort processes for zinc are described and the Sherritt Gordon process for nickel published in 1953 gets a reference of three lines.

The book opens with a long chapter entitled "Conspectus," which outlines the principles of non-ferrous extraction metallurgy. This contains six pages on "The Thermodynamic Approach" which perhaps should have penetrated the book more thoroughly. The Refresher Course on "The Principles of Extraction and Refining of Metals" published in 1951 by the Institution of Metallurgists might have acted as a guide in this respect, but does not appear to have been included in the bibliographies which are provided at the end of each chapter. This more scientific approach might have avoided the weak sentence on page 34 where in mentioning Professor Forward's recent work on leaching processes it is stated that during pressure reduction different metals "are apparently separately precipitated."

Foundrymen will be interested to know that in each chapter dealing with a given metal its commercial alloys are also briefly described, and coating and electroplating processes are outlined. Thus there is a little information on cast bronzes and gunmetal, the die-casting of zinc alloys and a good deal about bearing metals and solders. We are treated to a phase-diagram of the tin/lead alloys which appears to stand in isolation as the only example of such diagrams in the book. These little catalogues of alloys and properties are of doubtful value in a work of this kind, and the section on copper-base alloys is rather too flimsy.

The book is well printed and produced, with ample flow sheets and line diagrams, but with no half tone illustrations of plant. It makes easy reading and there are some interesting historical side lights on the history of prospecting for ores and the development of processes. H.O'N.

Täschenbuch der Giessereipraxis, 1955. (Pocket-book of foundry practice.) Published by Fachverlag Schiele & Schoen, Berlin, S.W. 29; price (cloth cover) DM 4.

The arrangement of the tables follows the usual pattern and contains all DIN-specifications useful to the foundryman. The text contains articles on "Production and Properties of Chromium Iron," "Meehanite" and "Spheroidal-graphite Cast Iron," (which are based on American and English developments and experience): "Marking-off of Castings," "Compound Casting Processes" and "Corrosion-resisting Alloys for Acid Pumps."

A short article on "Modification of Aluminium/Silicon Alloys" is followed by an extract from a paper "Gating Technique for Pressure Castings" which was published last year by H. K. Barton, in the journal "Practical Engineering." The best contribution is a well-illustrated article by Hans Reininger, "Systematic Development of Gating Practice" based on empirical experience.

The last two articles are a survey of "German Aluminium Casting Alloys and their Application" and "Degassing of Aluminium and its Alloys."

The book covers therefore the whole range of processes metals and alloys encountered in everyday foundrywork and should be of help to practical foundrymen. O.P.E.

THE ASSOCIATION OF BRONZE AND BRASS FOUNDERS (secretaries, Heathcote and Coleman, 69, Harborne Road, Edgbaston, Birmingham, 15), have got out an impressive four-page folder which sets out very clearly the advantages the Association offers to non-ferrous foundry owners. Non-members should certainly write to Birmingham for a copy.

Alterations of Rating Assessments

By "Barrister-at-Law"

The new revaluation of premises for rating purposes is now in progress, and one must expect that proposals for the alteration of existing assessments will be put forward. The chief grounds on which a proposal for an alteration is supported are because of a change of circumstance or a change of value, or because of improvements to the premises. Also, it must be observed that not only the ratepayer, but the Valuation Officer himself may put forward a proposal.

The following is a brief outline of the procedure in such cases. Every proposal whether made by the ratepayer or the valuation officer must be in writing and it must specify the grounds on which the proposed alteration is required to be made, and it must also state whether an increase or decrease in the valuation is desired; though on the other hand it does not appear to be essential to state the figure to which the valuation is to be increased or lowered.

Objections and Appeals

If a foundry owner desires an alteration in the rateable value of his premises, he must make his proposal to the valuation officer, and the latter, if he does not agree, will send a notice of objection. If the foundry concern wishes to proceed further in the matter, it must lodge an appeal against the objection with the local valuation court, and the notice of appeal must be served within 21 days of the receipt of the notice of objection to the proposal. The owner may appear himself before the local valuation court, and if he intends to appeal against the objection he should apply to his local valuation court for a form of notice of appeal. This notice of appeal must be served by him not only on the objector but on the rating authority as well. If the objection has been put forward by some person other than that valuation officer, the foundry must serve the valuation officer also with notice of the appeal.

Costs

It is desirable that at the hearing before the local valuation court the foundry concern should have the assistance of an expert rating surveyor, though there is nothing to prevent anyone from conducting the appeal personally. No costs are awarded to either side in proceedings before a local valuation court. However, if it is deemed desirable to take the matter further the concern will, if unsuccessful, have to appeal to the Land Tribunal. In the proceedings before this Tribunal, the firm will generally be awarded costs, if successful, whether as appellant or respondent, but if unsuccessful then liability for the payment of the costs of the opposite party will depend to some extent on whether the firm has brought the appeal, after being unsuccessful before the local valuation court, or whether it has been made respondent to the appeal, the firm having been successful before the local valuation court. Where a firm is not the appellant, it will generally be allowed costs, if the appeal fails; and if it succeeds no order for costs will be made against it. On the other hand, if the firm is the appellant against an adverse decision in the lower court, it will get costs if it succeeds in the appeal, but on the other hand if it fails, it will be ordered to pay the costs of the valuation officer, and this order will be made, even though the firm may not have engaged solicitors or counsel but have conducted the appeal personally. There is, however, no hard and fast rule as to costs, which are in the discretion of the Tribunal, but the practice appears to work out somewhat in the manner indicated above.

Increased Assessments

To deal now with the opposite case, that is, where the valuation office proposes to increase the rateable value of one's premises. There again, the "ball will start rolling" with the making by the valution officer of a proposal for the alteration, and this proposal will be served on the foundry. Immediately upon receipt of such proposal, the founder should write to the valuation officer stating his intention to object to the proposal and request him to forward a form for the purpose of making such objections. The founder should then state the grounds of the objection in the form and transmit it to the valuation officer. If the valuation officer desires to take the matter further, he will serve the firm with notice of appeal to the local valuation court, from which court there will be a right of appeal to the Lands Tribunal. From the Lands Tribunal, the matter can be carried further to the Court of Appeal on a question of law.

House Organs

Stantonian vol. 19, No. 4, December, 1954. Issued by the Stanton Ironworks Company Limited, near Nottingham.

In this issue there is a full account of the 36th annual prizegiving, when some 399 students had qualified for awards under the company's training scheme. It has been stated that the New Works Foundry was the first foundry in the world to be lit by electricity. Now, substance is lent to the claim by the inclusion of a cutting from "The Ilkeston Pioneer" of November 28, 1878, which announces this historic event.

Acier Moulé No. 2. Published by A.S.F.R.A.M., 45, Boulevard de Courcelles, Paris, 8.

This beautifully-produced, well-illustrated brochure carries as its main article a consideration of the potentialities of composite cast/welded components. It opens up with the rôle steel castings played in the construction of the Bathyscaphe. Next, railway and ships' castings are dealt with. A system of interleaving is used in the centre of the book, the insertions carrying well-worded precepts and slogans calling for co-operation between the manufacturer and his customer and designers. The propaganda value of these insets is indeed high. The bulletin runs to 36 pages and does real credit to the French steelfoundry industry.

Use of Cast-iron Ground-coats

By P. Rogers

A practical contribution to the beginners' study of vitreous enamelling. First, the reasons for the use of a ground-coat when enamelling cast iron are given and three types are outlined. The features of each type are then dealt with in detail, covering such phases as characteristic methods of application, precautions and finished results to be expected.

The cheapest and quickest way to vitreous enamel cast iron by the wet process is obviously by one-coat application direct to the iron and, where thermal shock resistance is important, the finished article will have a better performance when enamelled in this way. This can only be accomplished, however, if casting design and quality, enamel properties and standard of quality required, both visual and physical, are such that an economic level of acceptance at final inspection of the component can be achieved.

Very often this cannot be done consistently under normal shop-control conditions and it is found that slight variations in casting quality, or processing methods, result in an abnormal loss at inspection and, usually, interference with assembly programmes. If this occurs frequently for no very apparent reason, the use of a ground-coat and the extra processing time and expense involved must be seriously considered, so that a more uniform level of acceptance can be achieved, upon which production planning can be based.

The type of ground-coat to be used will depend on: 1. The severity of the "boiling" or blistering when enamelling is done direct to the iron. 2. The desired properties of finish required, *i.e., good* physical properties or good visual appearance or perhaps both.

Ground-coats can be grouped into three main types and it is proposed to discuss them separately, describing their application, advantages, disadvantages and the methods to be used if they are to achieve the desired object of controlling re-boil.

Vitreous or Glossy Ground-coats

Two types of the vitreous or glossy ground-coat class of ground-coat are in use, differing in their constituents and also in their application. Both are used on light cooker castings where a high standard of acid-resistance and thermal-shock resistance, must be achieved. They will only control re-boil of a minor nature over a fitting pad or boss and are of little value in controlling boiling from dirty, porous areas in castings, adjacent to runners.

The first type consists of a mixture of raw materials, principally borax, quartz and clay, the proportions being adjusted so that it matures at 800 to 840 deg. C. Its success in controlling re-boil depends upon sealing the casting surface after gas evolution during ground-coat firing and then presenting a viscous barrier of high fusing temperature to the passage of further gas during the fusing of the cover-coat. The ground-coat layer is completely vitrified by fusing, extremely adherent to the iron and mechanically strong in itself. Because of this, thermal and mechanical shock resistance of the finished castings will be little, if at all, inferior to direct iron enamelling.

The preparation of the castings must be of a standard equal to that required for direct-to-iron enamelling and rapid processing is essential if any advantage is to be gained from the use of the ground-coat.

The ground-coat is milled very finely, the usual practice being to mill for a set time, which, as experience has shown, will give a slurry with the desired characteristics for easy application. A thin, even, wet coat of 0.003 to 0.004 in. is applied with a small-nozzle spray-gun using a low air-pressure. Good atomization is essential to avoid tiny, thin spots caused by droplets striking the wet layer. Air drying is practicable in some shops having a high room temperature but, due to the high water content of the slurry, rust-spotting easily occurs and artificial drying is desirable so that this can be avoided.

Milling of the ground-coat should be closely related to production requirements, as borax can crystalize out in the slurry if stored too long, particularly in cold weather, and this will produce a dispersed fine re-boil, when subsequently cover-coated and fused.

Fusing

Fusing should be carried out at a suitable temperature and the fused castings should present a smooth slightly glossy appearance of a dark-grey colour, the latter depending upon whether or not any colour oxides or opacifiers have been added to the ground-coat to make it more opaque. The coating should be even, free from beads on edges and areas where the ground-coat has burned away, allowing the iron to oxidize.

Cover-coating should be carried out with the minimum of delay after the fused ground-coat has been inspected, as long standing of ground-coat after fusing leads to re-absorption of moisture by the borax and subsequent blistering in cover-coat. This is accelerated by humid weather conditions. The application of the cover-coat is very similar to direct application but the mechanical bond between the cover-coat layer and the glossy ground-coat layer is weak and "crawling" occurs more readily if cover-coat enamels are overground, or applied too heavily. Drying should not be done at too high temperatures for similar reasons.

* Paper presented to the Institute of Vitreous Enamellers Summer School. The Author is associated with Wilson & Mathiesons Ltd.

Use of Cast-iron Ground-coats

Re-coating or re-firing of work processed in this way is seldom successful, a possible explanation being that, during fusion of the ground-coat and cover-coat, iron oxide is dissolved by the ground-coat, reducing its fusion temperature to such an extent that it does not offer any barrier to the passage of gases during the re-operation fusing.

The second type of glossy ground-coat, which has been widely used in recent years, consists of a normal clear enamel, selected for its fluidity at fusing temperature and also for its good thermal-shock properties, hardened by the addition of up to 25 per cent. of refractory, such as quartz. The ground-coat is applied as a normal enamel to a fired thickness of 0.005 to 0.007 in., observing the usual requirements of even coating, and subsequent cover-coating is similar to the methods used on the thin, glossy ground-coat. These latter ground-coats have several advantages over the former; milling is simpler as they are milled to a definite fineness as with a normal enamel; storage of the slurry is not critical; a heavier coating is applied which is fused down very flat, giving a very good appearance to the subsequent fused cover-coat layer. Re-processing of defective work is practicable, provided delay is kept to a minimum.

Annealing Ground-coats

Annealing-type ground-coats are raw-material mixtures but contain a higher proportion of refractories than the thin-glaze ground-coats. As the name suggests, they are intended to be fused to the iron at approximately annealing temperature and the ground-coat firing replaces the normal anneal, provided the castings are free from oil or grease. They are used principally on good-quality, light-section castings as they will only cope with boiling of a minor nature and good casting-preparation and rapid processing are essential if consistently good results are to be achieved.

The ground-coat is milled to a definite fineness of, say, 1-3 gm. residue on a 150-mesh screen and, once again, milling should be in step with requirements, as the slurry does not age well, due to re-crystalization of the free borax. The main difference between these ground-coats and the thin, glossy ground-coats is in the method of application of the ground-coat itself. It is found that the best results are achieved if the ground-coat is applied as a thin, dry, dusty coating using a small-nozzle spray-gun and a wide, fan-type spray. The application is rather difficult as great care must be taken to keep the coating thin without missing edges or building up dusty accumulations in corners.

The specific gravity of the slurry, air-pressure and fluid delivery must be controlled so that good atomization is achieved and so that a coarse, gritty surface is not produced, as this will persist through subsequent processing and be apparent in the appearance of the fused cover-coat.

Air-drying of sprayed ground-coat is quite practicable, but should occupy enough time to ensure that it is complete. The fused ground-coat should have a grey-to-black appearance with a surface like fine sand-paper; there should be little, if any, appearance of glazing. Underspraying can be detected by the smoother, brownish appearance of oxidized iron, where the ground-coat has burned away.

Inspection of fused ground-coat should be carried out, to ensure that all surfaces to be cover-coated have received an adequate layer of ground-coat as flaking will occur if a cover-coat is applied to areas where the iron surface has become oxidized. Cover-coating should be carried out quickly, as, apart from the possibility of the ground-coat re-absorbing moisture, the rough surface picks up shop dust which is difficult to remove. The fused ground-coat layer is somewhat absorbent, and cover-coat slurries should be rather thinner than normal to prevent dry deposits in corners during spraying.

Drying of such a cover-coat should not be done at higher temperatures than 180 to 190 deg. F. and care must be taken to ensure that drying is complete before fusing. The mechanical bond between the ground-coat and cover-coat is stronger than with those previously described and fineness of grinding and thickness of cover-coat application are not quite so critical.

Re-coating or repair and re-firing of rejected work is seldom practicable, and in most cases rejects have to be stripped and re-processed.

Matt Ground-coats

Matt ground-coats are completely different from the types already discussed in the way in which they achieve their object of controlling re-boil. They are far more successful in preventing evolved gases which produce eruptions in the cover-coat, and are widely use to achieve successful enamelling on large castings of indifferent quality with wide variations in section thickness. It would be quite true to say that castings can be enamelled, using these ground-coats, which could not be economically processed otherwise.

Unfortunately, the very nature of the ground-coat layer is such that good mechanical and thermal-shock resistance cannot be achieved and the use of these ground-coats should be restricted to castings where good visual appearance is the major consideration. Close process control is essential if maximum adherence, together with successful control of boiling is to be achieved. These types of ground-coat control boiling by interposing a porous layer between the iron and the cover-coat, which has an inherent capacity to absorb gases and, in addition, probably acts as a diffuser, preventing large gas-bubbles from building up and bursting through the cover-coat.

Milling of the ground-coat in this case should be balanced with requirements, and consistency of milling is important because a slurry which is uniform as regards fineness and "set" will enable application conditions to be laid down and rigidly enforced. Over-grinding will result in an over-set slurry which will be difficult to atomize and smooth spraying will be impossible. Over-grinding also reduces the *bisque* strength and cracking may

occur in drying and fusing, resulting in poor adherence.

The high standard of casting-preparation required for other types of ground-coat is not so essential for this type; annealing is unnecessary, apart from grease or oil removal, and castings which warp readily in shot-blasting can be kept straight by reduced blasting pressure. This is particularly useful when shot-blasting is done by airless methods, reduction of the grit feed producing the same result.

The ground-coat is applied to a thickness of 0.005-0.007 in., using a well-atomized, wet spray. Use of too large a fluid nozzle results in poor atomization, producing a pitted surface with local thin spots. It is of the utmost importance that the ground-coat layer should be applied perfectly smoothly and be free from ripple, beading on edges and dry, gritty accumulations in corners, as these defects do not flow out during fusing and will be quite obvious in the appearance of the fused cover-coat.

Drying of the ground-coat must be done slowly at a maximum temperature of 190 deg. F.; air-drying can be adopted if shop temperatures are high enough to prevent rust-spotting. Forced drying causes the *bisque* layer to crack, with resultant poor adherence after fusing.

Fusing is carried out at 760 to 820 deg. C. according to the composition of the ground-coat and is again extremely important, the object being to sinter the ground-coat layer to produce maximum mechanical strength without destroying the porous structure. Simple tests can be applied to the fused layer to determine whether or not this has been achieved—it should be hard enough to withstand scraping with a pen-knife blade and yet should really absorb a drop of water placed on the surface. Under-fusing produces a soft surface which, whilst quite successful in controlling re-boil, will have poor mechanical strength and flaking of the cover-coat will occur either spontaneously or upon slight impact, the ground-coat layer shearing because of its softness. Over-fusing vitrifies the layer, destroying its porous structure and, consequently, its ability to absorb gases, thus reducing its efficiency to control boiling. If possible, the fused ground-coat should be racked as is fused cover-coat ware and not piled in heaps on trolleys, as the layer can be readily damaged and considerable "stoning" has then to be done during preparation for cover-coat spraying.

Inspection of the fused ground-coat should be made to verify that it has been fused correctly, is free from cracking, ripple, protruding gritting particles and oxidized areas, caused by damage to the *bisque*. Underfired work should be returned for re-fusing, work showing cracking should be stripped, gritty particles lightly stoned off and bare spits heavily stoned to obtain a clean iron surface.

Application Details

Cover-coat slurries must be thinner than for direct application, otherwise, dry-spraying and heavy, dusty deposits will occur in corners, due to absorption of the cover-coat water by the ground-coat. This can be very troublesome in hot weather or in very warm shops and pre-wetting of the corners before spraying will be found to help considerably. Crawling back of the cover-coat will occur unless steps are taken to avoid these loose, dry deposits.

Owing to the opaque nature of the ground-coat, less-opaque cover-coats can be used and a thickness of 0.012 to 0.015 in. should be adequate, giving a total finished thickness of 0.017 to 0.020 in. Drying should not be forced and dryer temperatures should not exceed 190 deg. F. Great care must be taken to ensure that the work is completely dried out before fusing. Fusing is of interest, as the cover-coat can be fused-out flatter than usual, the under layer of opaque ground-coat preventing sharp edges from showing as dark lines.

Re-spraying or repair and re-fusing of defective work is practicable when using matt ground-coats; in fact, two or more cover-coats are quite common, using this type of ground-coat. Delay between fusings should be kept to a minimum, particularly when large castings which are expensive to process are being enamelled; inspection, repair or re-spray, and re-fusing should be carried out as soon as possible, so that stripping is reduced to a minimum.

Conclusion

In conclusion, the use of ground-coats is an additional expense which must be justified by improved performance as against properly conducted direct-to-iron enamelling. Ground-coats should not be introduced—and this particularly applies to matt ground-coats—to enamel the type of castings where a little better shop-control would allow them to be enamelled quite successfully by the direct-to-iron process. Shop supervisors must realize that the introduction of a ground-coat does not reduce their responsibilities but adds to them, as it is an additional process requiring close control; if it is to achieve its desired object and, particularly with annealing and vitreous ground-coats, no relaxation of any other detail of processing can be permitted.

Finally, thanks are due to the directors of Radiation, Limited, for their permission to prepare and present this paper and to colleagues at Wilsons & Mathiesons, Limited, for their helpful suggestions and comments during its preparation.

Spanish Steel Output Record

Spanish steel output in 1954 was more than 1,000,000 tons. Reporting this at a Press conference in Barcelona, the Minister of Industry said that last year's output had surpassed even the record year of 1929. He also stated that coal output had increased by 200,000 tons and now stood at over 10.000,000 tons, although it had been necessary to import a further 1,000.000 tons last year.

Dealing with other aspects of Spanish industry, the Minister reported that the electricity supply had been increased by 26 per cent., in spite of the drought. The output of cement would soon reach the target of 5,000,000 tons a year which the Government needed for its irrigation, housing, and electricity schemes.

South Wales Institute of Engineers

The annual dinner of the South Wales Institute of Engineers was held at the Park Hotel, Cardiff, on January 20, Mr. J. Roy Tallis presiding.

Proposing the toast "The Institute and President," Major Noel E. Webster, president of the Institution of Mining Engineers, said the South Wales coalfield presented one of the greatest challenges to mining engineers and technicians. He recalled that the manpower had declined from 250,000 in 1913 to just over 100,000 and that output had fallen from 56,800,000 tons to about 24,000,000 tons. Now, he continued, the NCB had decided to invest about £100,000,000 in developing the coalfield, which had enormous reserves, particularly of rich coking coals. But the implementation of such a scheme, he concluded, must depend on skill and resource in overcoming physical conditions and stimulating human responses.

The toast "The Industries of South Wales and Monmouthshire" was proposed by Principal J. S. Fulton, who pointed out the danger of specialists in various branches of knowledge getting out of touch with each other, and was responded to by Mr. G. S. Morgan. The toast "Kindred Societies and Guests" was proposed by Prof. W. R. D. Jones and responded to by Mr. E. Hywel Jones, of the South Wales Division, British Electricity Authority.

Needs of Industrial Injuries Fund

While the increased income for the industrial injuries fund under the 1954 National Insurance Act is more than adequate at the moment, it will not meet the eventual cost of the increased benefits, says the Government Actuary in a report on his first five-yearly review of the operations of the National Insurance (Industrial Injuries) Act, 1946. It is estimated that over the next 25 years the increases in contribution rates will provide slightly less than half of the additional income required, and to ensure the solvency of the fund the new contributions should be raised by 18 per cent.—about 1d. a week each from employer and adult males, with smaller sums from women and juveniles.

The report says that on the basis of the new rates (of the 1954 Act) the ultimate annual cost of benefits and administration will be about £69,000,000 and the ultimate annual income from contributions and Exchequer supplements about £47,500,000.

Shipbuilders' Technical Progress

On their ability to maintain the lead in technical efficiency while keeping costs competitive depended the future of the shipbuilding and engineering industries, the North East Coast Institution of Engineers and Shipbuilders was told by the Minister of Transport and Civil Aviation, Mr. J. A. Boyd-Carpenter, recently. He knew of the difficulties facing the shipbuilding and engineering industries and was gratified to know that in 1954 1,500,000 tons of shipping was built in British yards.

Although order-books were not quite as full as they had been, there was some consolation to be gained from this, as it might affect the placing of orders by shipowners anxious about delivery dates, went on the Minister. He was glad to know of the advance in technical progress, especially in propulsion, made by British yards. The gas turbine was only one example of the determination to keep ahead on technical matters.

Metal Industries Expansion

With an authorized capital of £100,000, Metind, Limited, has been registered as a new subsidiary of Metal Industries, Limited. The new company will operate from a factory to be constructed in the Bromborough area, which will initially undertake work of a repetitive nature, including the manufacture and assembly of small sub-units required mainly in the electrical and engineering divisions of the group.

Mr. K. N. Swash has been appointed chairman and managing director of the company. The other directors are Mr. F. R. Livock and Mr. T. D. Turner.

Metal Industries has also acquired the whole of the issued share capital of Finney Presses, Limited, Birmingham. This company manufactures hydraulic accumulators for the aircraft industry and for industrial use, hydraulic presses for the plastics and other industries, and hydraulic equipment generally. The board of the newly constituted company consists of Mr. J. Black, chairman, Mr. J. Trevor-Jones, managing director, and Mr. L. Davies.

Negotiations have now been completed with the Rheostatic Company, Limited, for taking over, as from April 1, the latter's business relating to the manufacture and sales of unbreakable resistors for use with heavy electrical equipment.

Iron-ore Imports

Iron-ore imports in December, and the total for the year compared with that for 1953, are shown below.

Country of origin.	Month ended December 31.	Year ended December 31.	
	1954.	1953.	1954.
	Tons.	Tons.	Tons.
Sierra Leone	44,150	779,841	623,971
Canada	104,743	1,118,464	1,004,565
Other Commonwealth countries and Eire	1,067	188,786	35,683
Sweden	338,273	3,805,837	4,183,287
France	42,377	446,391	450,190
Spain	28,996	442,503	494,137
Algeria	161,249	1,852,872	2,112,875
Tunisia	44,875	581,592	603,537
French Morocco	18,100	270,941	255,287
Spanish Morocco	11,900	259,330	251,112
Liberia	18,080	273,109	215,809
Brazil	36,670	306,425	469,098
Other foreign countries	68,038	654,972	919,539
TOTAL	918,518	10,981,063	11,619,090

ICI Directorship Changes

Lord Chandos has been appointed to the board of Imperial Chemical Industries, Limited. He will act as a non-executive director. Lord Chandos, formerly Mr. Oliver Lyttelton, received his viscountcy last year following his resignation as Colonial Secretary. He is chairman of Associated Electrical Industries, Limited, and British Thomson-Houston Company, Limited.

ICI has also announced other directorial changes to take effect from February 1. Mr. C. Paine is to be development director, Mr. C. R. Prichard is to be joint overseas director with Mr. E. A. Bingen, Mr. W. D. Scott is to be director in charge of Group C (Ammonia and Agriculture), and Mr. R. C. Todhunter is director in charge of Group E (Paints and Plastics).

Railways Reorganization

£1,200,000,000 *Scheme implies Heavy Demand for Castings*

Plans for the complete re-equipment and modernization of British Railways in the next 15 years were outlined in the £1,200,000,000 scheme announced by the British Transport Commission last week. The scheme signals the end of the steam locomotive and opens an era of extensive electric and Diesel traction. It proposes that no new express passenger or suburban steam locomotives should be built after the 1956 programme, and that the building of all steam locomotives should end within a few years.

The plans announced last week for railways reorganization in this country includes the electrification of the main lines from King's Cross to Doncaster, Leeds, and possibly York; from Euston to Birmingham, Crewe, Liverpool, and Manchester; and from Liverpool Street to Ipswich. Moreover, some 2,500 Diesel mainline locomotives would be built at a cost of £125,000,000 by the end of the period covered by the plan. It is intended that work on the principal schemes should be fully under way within five years.

It is proposed to spend £230,000,000 on 31,000 new passenger carriages, and £150,000,000 on 225,000 freight wagons to be fitted with continuous brakes. Over a quarter of the total investment would be devoted to "a drastic remodelling" of freight services and marshalling yards to reduce turn-round time by about 30 per cent., with a consequent reduction in wagon stock.

The commission estimates that the plan would bring about a "minimum economic improvement" of £85,000,000 a year, but the service of new capital, additional depreciation charges, etc., would amount to some £80,000,000 a year. The commission proposes to furnish £400.000,000 of the proposed investment from its own sources.

Speeding Freight Services

As regards freight services, the BTC says that there will be a complete reorientation of operations designed to speed up movement, to reduce its cost, to provide direct transit for main streams of traffic, and to attract to the railway a due proportion of the full-load merchandise traffic that would otherwise pass by road.

The 20,000 route miles of British Railways rank among the greatest of our national assets, it is stated. Although the main trunk lines were constructed over a century ago, their engineering standards are still among the best in the world. Under the plan £210,000,000 is allocated to the track and its associated works, such as bridges and tunnels, and to signalling and telecommunications.

In reaching its decision to effect a changeover from steam to electric and Diesel traction, the commission has given careful consideration to the merits of all the various forms of traction. In the past, it points out, the steam locomotive served the railways well. It has the virtues of low first cost, simplicity, robustness, and long life. On the other hand, many factors combine to indicate that the end of the steam era is at hand. These include the growing shortage of large coal suitable for locomotives and the insistent demand for a reduction in air pollution by locomotives and for greater cleanliness in trains and stations.

The main scope for development at present rests with electricity and Diesel traction. In many ways electricity is the ideal, since it meets the requirements of reliability, good acceleration, cleanliness, and (where the traffic is sufficiently heavy) economy in operation. Under electrification, moreover, the direct cost of train movement is considerably reduced as compared with steam, though owing to the increased capital investment a certain minimum traffic density is required before electrification can compare favourably as regards total costs of operation. As traffic density increases, however, the comparison becomes increasingly favourable to electricity.

The main disadvantage of electrification is that it frequently involves substantial engineering works on track and structures, signalling, and telecommunications. In consequence, converting a length of line to electric traction is a complex operation, involving a considerable period of preliminary planning and coordination of effort between various railway departments and outside contractors, and some disturbance of the services during the execution of the work.

A further consideration is that in some cases in the past the riding qualities of electric multiple-unit stock have not equalled those of modern vehicles hauled by a separate locomotive. Research has however been undertaken into the design of bogies for electric multiple-unit vehicles, and it is confidently expected that future designs will provide an entirely satisfactory standard of passenger comfort.

Advantages of the Diesel

Diesel traction offers many of the advantages of electricity in the shape of cleanliness, acceleration, and uniform standard of performance. It has a further advantage in that the changeover from steam to Diesel working generally does not involve important civil engineering or signalling works, and can be effected as quickly as the Diesel units can be built.

On the other hand, on the lines of heaviest traffic the potential economies are less with Diesel traction than with electrification. The present cost of a Diesel locomotive is about two and a half to three times that of a steam locomotive of equivalent power and, to yield economic results, Diesel locomotives must achieve a very high degree of utilization, approaching closely to their theoretical availability, in order to spread the capital charges over a sufficient total volume of remunerative work.

The use of atomic power in relation to railways, says the BTC, seems likely to be indirect, namely through the use of nuclear energy at electric power stations, rather than through the development of atomic-powered locomotives. The extension of railway electrification will enable the commission to take advantage of the possibilities flowing from the introduction of atomic power.

With these considerations in mind, the commission is agreed that, in broad terms, it is not a question of choosing between electricity and Diesel traction, but rather of combining the two to the best advantage. The plan is flexible enough to enable advantage to be taken of any technical developments, including gas-

Railways Reorganization

turbine propulsion, that may become available and economically justified as the work progresses.

The present programme for the construction of Diesel shunting units in replacement of steam locomotives will be completed in 1957, and a further programme is in course of preparation. It is considered that the complete elimination of shunting and trip working by steam locomotives should be achieved over the next 15 years. The total number of steam locomotives that will be displaced by this conversion is approximately 1,500. They will be replaced by about 1,200 Diesel locomotives, additional to those already authorized, at a total cost of about £25,000,000. The total cost of the main-line Diesel locomotives to be built under the plan is £125,000,000.

Hitherto, the Diesel main-line locomotives on British railways, have comprised a handful of prototypes, and various "teething troubles" have been experienced. Much useful experience has, however, been gained and, in view of the high degree of reliability attained in other countries where Diesel traction has been widely adopted, there is no reason to doubt that equally satisfactory results will be realized here, once the decision has been taken to make Diesel traction a standard feature.

Residue of Steam Traction

Although it is proposed shortly to bring to an end the building of new steam locomotives, there are at present some 19,000 steam locomotives on British railways, a substantial proportion being of modern design. The steam locomotive has a useful life in service of some 40 years, the commission continues, and obviously careful planning will be required to ensure that, as the existing stock is gradually replaced by Diesel or electric power, it is still used to the best advantage.

As regards steam motive-power depots, many of these require to be rebuilt or substantially modernized; and if no change in the present types of motive power were contemplated there is no doubt that a considerable expenditure would have to be incurred on essential improvements. It is estimated that a sum of £10,000,000 should cover the expenditure.

The plan provides for the construction or reconstruction of some 55 marshalling yards, which would result in the total or partial closure of about 150 existing yards. It is broadly estimated that these proposals would cost about £80,000,000.

More scope for the use of larger wagons exists in mineral traffic, where the commission has recently introduced the largest coal wagon that can run on two axles on British railways, with a capacity of 24½ tons. The problem of replacing the existing wagons of lower capacity by the new 24½-ton wagon is a complex one, involving the adaptation at considerable cost of terminal facilities and loading appliances, many of which are outside the commission's ownership. The commission has, however, decided that by 1974 half the coal-carrying capacity on British Railways should be provided in 24½-ton wagons.

Cleaning of Castings

It is with regret that we record that a number of credit lines for the illustrations of Mr. Childe's paper "Cleaning of Castings" in last week's issue were misplaced. Fig. 1 should have been credited to Spencer & Halstead, Limited; Fig. 2 to H. G. Summerfield, Limited, Ministry of Supply, and Leyland Motors, Limited; Figs. 5 and 9 to H. G. Summerfield, Limited; and Fig. 10 to Spencer & Halstead, Limited. Apologies are tendered to all who may have been confused.

Lloyd's Supervisory Training

A year ago, ten young men—aged 25 to 35—knew little or nothing about steel foundries or about handling industrial workers until F. H. Lloyd and Company, Limited, put them through a course which covered almost everything from speaking to mountaineering. Nowadays most of them hold key jobs with the firm. It all began because Lloyd's could not fill all its supervisory positions with men who had served their apprenticeship at the firm. It was then decided to run an experimental supervisor's course. One hundred and fifty men applied, and from these, ten were selected. Two were railway clerks, one was a metal patternmaker, another an assistant foreman in an ironworks and the others from varying occupations.

They were given practical and theoretical training in the works and an overall picture of every department. They wrote essays, were told how to improve their self-expression in speaking and writing—and were sent, three at a time, with 15 apprentices, to spend a week-end on Snowdon on a £15 budget.

Four of the trainees, it is reported, now show every indication of becoming very good supervisors. Two more are in specialist jobs. The other four are expected to be good supervisors after a little more experience. The company is so pleased with its experiment that it is planning another supervisors' course. And technical colleges and industrialists throughout Britain and a large group of companies in Australia have asked Lloyd's to tell them how the scheme works.

Steel Scrap Price Allegations

At Bow Street Magistrates' Court last month, Mayer, Newman & Company, Limited, of Arundel House, Arundel Street, London, W.C.2, was summoned for selling steel scrap at prices in excess of the maximum. There were 45 summonses, all in relation to steel scrap alleged to have been sold to Glanmor Foundry Company, Limited, Llanelly (Carms). The magistrate, Mr. R. H. Blundell, committed the company for trial at the London Sessions.

Mr. Edward Clarke, prosecuting for the Ministry of Supply, said that all the transactions were alleged to have taken place during 1953. The case for the prosecution was that, although the defendant company had charged proper prices for the scrap, it had added to the invoice the cost of the carriage, which brought the total charge above the maximum price. On about 500 tons of scrap there was an overcharge of £900.

Mr. Brian W. Jerrom, an officer of the Ministry of Supply, said in evidence that the invoices showed prices slightly lower than the permitted maximum, but haulage charges were added. When he spoke to two directors of the company, Otto Mayer and Harry Newman, about the matter they said they would see their solicitors before making a statement.

Papers for 1956 IBF Conference

The Council of the Institute of British Foundrymen is prepared to receive offers of papers for presentation at the 53rd annual conference to be held in June, 1956. Members and non-members who contemplate offering papers are asked to communicate immediately with the secretary who will forward them a copy of the Institute's publication "Notes for the Guidance of Authors of Papers." It is desirable that all formal offers of papers should be made not later than June 1, so that they can be considered by the meeting of the appropriate committee which will be held later in the month of June.

Clean Air Bill

The text of a private member's Bill which seeks to implement the principal recommendations of the report of the Beaver Committee on Air Pollution, with the exception of those entailing fiscal changes and those within powers of direction, exercisable by Ministers under the nationalization statutes, has been published.

Presented by Mr. Gerald Nabarro, MP for Kidderminster, and supported by 11 other members on both sides of the House of Commons, it is due to come up for second reading tomorrow.

Setting up Smokeless Areas

The clauses of the Clean Air Bill include legislation to enable local authorities to establish smokeless areas, and to prohibit by Order the sale of bituminous coal for domestic purposes in specified areas, subject to the approval of the Minister of Housing and Local Government, who shall not confirm such an Order until satisfied as to the availability and price in the area of suitable smokeless fuels.

Clauses affecting industry include that, from the appointed day, no person shall instal any furnace for manufacturing or trading purposes unless it is capable of being operated continuously without dark smoke, that no such furnaces designed to burn pulverized or solid fuel at a rate exceeding 10 tons per hour shall be installed unless provided with effective and approved grit-arresting plant, and that after three years from the passing of the Bill the emission of dark smoke shall be an offence, subject to certain exceptions.

Legislation is suggested to include in the Alkali, etc., Works Regulation Act, 1906, metallurgical works, power-stations, gas and coke works, ceramic works, and lime works. Nothing in the Bill should then apply to such scheduled works and processes under that Act; but local authorities should be empowered to apply all the relevant provisions if the responsible Ministers were satisfied that any local authority had sufficient technical facilities and staff properly to control the emission of gases, fumes, and smoke from the scheduled works and processes.

Mr. Duncan Sandys, Minister of Housing and Local Government, announced in the House of Commons last week that the Government had decided in principle to adopt the policy recommended by the Beaver Committee. The Minister said that the main recommendations of the Committee contained far-reaching proposals, involving complex technicalities, the expenditure of much money, and issues of policy which directly affected local authorities, industry, and private individuals.

Preliminary discussions between himself and representatives of local authorities and the Federation of British Industries indicated that industry would be ready to help and that local authorities would be prepared to accept the additional responsibilities involved. At the same time, the Minister of Fuel and Power was giving his attention to the question of increasing the availability of the smokeless fuels that would be needed.

While reserving their position on individual proposals, said Mr. Sandys, the Government had decided in principle to adopt the policy recommended by the Beaver Committee. He hoped before long to make a statement about legislation.

Speaking in London later in the week, Sir Hugh Beaver warmly welcomed the Government's decision to adopt in principle the Committee's recommendations. What was wanted, above all, was that legislation to combat fog should be in existence, and in the first stage towards implementation next winter.

To secure that, he said, would necessitate rapid and intensive action. Sir Hugh said that his Committee envisaged an all-embracing new Act of Parliament that would sweep up into one coherent and workable whole all the bits and pieces of legislation and regulation that the piecemeal approach to the problem over the years had produced.

What might well be the most important point of all was their emphatic recommendation that the new Act should lay down that "clean air" was the national policy. This would mean, for instance, that the nationalized industries which, under their several Acts, were to operate in the interests of national policy, would have that authoritative standard by which to measure their individual policies.

If the opportunity was not to be missed, a carefully considered and comprehensive Act was required, said Sir Hugh. It was difficult to see how it could be put through this year unless it was treated like an agreed measure—not as to the details but as to the principles—so that the brains of Parliament could be devoted wholly to making the Act effective and workable. Sir Hugh said that he did not see how all that he had indicated as necessary could be secured in a private Bill. Mr. Nabarro was greatly to be congratulated on his initiative, but he could not see success being really achieved unless the Clean Air Act had behind it all the force of Parliament—both sides of Parliament—and the combined efforts of the many departments concerned.

American Investment in Scotland

Scotland has over 75 per cent. of the US corporations which have set up plant in the United Kingdom since the war. While this estimate was gratifying for Scotland, Lord Bilsland, president of the Scottish Council (Development and Industry), found it disturbing, because, he said, it showed that the Scottish Council was apparently the only organization in the UK going out to attract American investment, whereas every other country was doing everything possible to do so. Lord Bilsland was making his annual appeal to the Scottish public for a minimum of £35,000 to carry on the work of the Council and he included a review of its efforts in the past year.

The Scottish Industries Exhibition created great interest and secured widespread publicity in America, said Lord Bilsland. The mission to the US and Canada, undertaken before the exhibition by a delegation of the Council, had proved most successful in the contacts made with buying organizations and in new plant investments secured from the United States. He calculated that when the new firms attracted to Scotland as a result of the visit of that mission had developed their activities, it would mean 6,000 new jobs for Scotland.

The president revealed that three more American firms were contemplating setting up branch factories in Scotland. One of the firms was concerned mainly with the manufacture of tools which would require a considerable amount of Scottish steel. The second came within the category of "very light engineering," while the third was concerned with a branch of the chemical industry.

Lord Bilsland left by air for the United States last week and hoped to have the opportunity of meeting representatives of certain corporations in New York. He would also be meeting leading bankers there whom he had found useful in inquiries regarding Scottish industrial prospects.

Brazil's Expanding Industry

Since Brazilian steelmakers began increasing the volume and range of production, a new impulse has been given to the country's metallurgical industry. Manufacturers are now able to meet the demand for a comparatively wide range of domestic appliances as well as for certain works and office equipment. Output of hand and machine tools, which until recently was insignificant, is beginning to expand.

Two firms in Brazil are now producing seamless steel tubes; other are making pipes for drainage and water systems, as well as steel drums and tanks for petroleum and other liquids. Quite recently the first bicycle factory was inaugurated in the Federal District, with an initial output of 50,000 units annually, including motor-cycles and pedal machines. Babcock & Wilcox, Limited, will shortly start building steam boilers at Rezende, in the State of Rio. Later the factory will turn out electric overhead travelling cranes, jib cranes for port works, pressure vessels for chemical industries and oil refineries, etc., and prefabricated piping.

The manufacture of electrical materials has developed spectacularly in Brazil and is now the foremost industry of its kind in Latin America. Seven important foreign firms began making their products locally after the last war, in order to compete with five big Brazilian enterprises assisted technically and financially from abroad. The market is now self-sufficient in the matter of electric installation materials, including high-frequency insulators. Four factories are turning out 60,000 monophase and 10,000 three-phase motors monthly and application has been made to declare locally-made transformers up to 4,000-kVa. and 69-kV. adequate in quality and quantity for market needs. Eighteen factories and a large number of small assembly plants are producing wireless receiving sets. Approximately 70 firms are engaged in the manufacture of heavy electrical material, 200 are producing electrical apparatus and light materials, and an Austrian manufacturer is to make medium-sized turbines and pumps.

Output of Railway Equipment

The five principal manufacturers of railway material are building 20 wagons daily, including all-metal refrigerator and other cars; 2,000 tons of cast-iron parts, 7,500 wheels, and 1,500 tons of forged pieces are being turned out monthly. Volta Redonda is supplying an ever-increasing number of rails and the first oil-burning locomotives built in Brazil are now running over State-owned railways. In August, Metropolitan-Vickers Electrical Company, Limited, opened a factory to carry out maintenance work for electrified railways in Brazil and is reported to be considering plans to co-operate in the development of the heavy electrical industry.

Increasing steel production and expansion of the metallurgical industry have facilitated the birth of an automobile industry in Brazil. Factories manufacturing parts and accessories now number 387. The National Motor Factory is building 8-ton Alfa-Romeo lorries and Fiat 25-R tractors and is about to amplify its installations; 38 per cent. of the weight of each vehicle is produced locally, but this percentage will shortly be raised to 70. A factory is now under construction to build Volkswagen cars in Brazil and a Wilhelmshafen firm has organized a Brazilian subsidiary to make omnibuses and lorries in Sao Paulo.

In 1953, 280,000 medium-weight lorries were circulating in Brazil, and 35,000 of these require replacement annually. Attracted by the prospects of a guaranteed market, General Motors has purchased 360 acres of land at Sao Jose dos Campos and is preparing for an initial production of 50,000 lorries annually. Vemag has purchased a site at Taubate, Sao Paulo, and Mercedes-Benz aims to do likewise. Ford engineers are now in Brazil, completing plans for an establishment similar to that of General Motors, and Mr. Henry Kaiser announces that he will put up a factory to manufacture 50,000 automobiles annually.

Works Under Construction

A factory is now being built to manufacture steel wire wheels for motor vehicles; Cobras is installing new forging plant; Cofap is extending its range of production; Piratininga Machines is building a foundry with capacity for 800 tons monthly; the Atlas Foundry is increasing output of special steels for the motor industry, and Sofunge is raising capacity to 1,200 tons monthly and will also manufacture hammered steel pieces.

Etablissements Richard Frères, of Lyons, is to build agricultural tractors and machinery in Brazil and Eberhardt Agricola will shortly begin making farm implements in Sao Paulo.

Brazil requires 78,000 tons of special steel annually, of which 40,000 tons are needed for automobile springs and other industrial purposes. Acesita, in Minas Geraes, and Acos Villares, in Sao Paulo, will produce 25,000 tons annually and the last-named is preparing to increase output 200 per cent. by means of new installations and equipment. Brazil's reserves of high-grade hematite, of nickel in Goias, tungsten in the north-east, chromite in Bahia, and manganese in Amapa and Minas Geraes will facilitate the manufacture of special steels in adequate quantities to meet domestic requirements.

Hitherto, local production of steel has been largely absorbed for buildings, bridges, railways, and other permanent works, but an increasing proportion is now going into machinery, tools, vehicles, apparatus, and utensils of every description. Prof. Mehl, reporting to the Brazil-USA Mixed Commission in 1952 estimated local requirements of steel at 1,700,000 tons in 1960 and in 1980, when the population is expected to reach 100,000,000, at 6,000,000 tons, or 60 kilos per head. The National Council of Mines and Metallurgy, on the other hand, including in its estimate the future needs of the petroleum, automobile, shipbuilding, and other new industries, placed the probable requirements in 1960 at 2,500,000 tons of ingots. The target is not an impossible one; production reached 1,002,000 tons in 1953 and the various projects now in course of execution will add a further 1,030,000 tons within the next three or four years. These projects include an initial output of 350,000 tons at the Piassaguera plant, near Santos, but not the second stage of its expansion programme, which will double capacity by 1960.

The year 1954 has been one of great activity in the various sectors of the metal industry. During the first 10 months 301 permits to prospect for minerals were issued, 80 concessions were granted to exploit proved deposits, and 52 new mining companies were registered. By the end of September new capital investments had reached £21,806,000 in the iron and steel industry and £13,954,000 in metallurgical enterprises.

Shell-moulding Lectures

The National Foundry College, in conjunction with the West Midlands' Advisory Council for Technical, Commercial and Art Education, is organizing a course of six evening lectures on shell moulding, to be held at the College on Thursday evenings, starting on Feb. ruary 17 at 7 p.m. The course fee is £2 2s. Details are available from the Head of the College—Mr. J. Bamford, B.Sc., Stafford Street, Wolverhampton. Enrolment may be made by post or personal application at the College. Entries will be accepted, provided places are still available, up to February 16, 1955.

The course has been planned as a review of the materials and equipment used and the various methods adopted in shell moulding for foundry executives, metallurgists and students. The individual lectures are:— "History, Patent position, and outline of the process," by J. Bamford, B.Sc.; "Sands used," by D. A. Taylor; "Binders," by J. L. Rice, B.Met.; "Pattern equipment," by S. A. Horton; a symposium on equipment by representatives of various manufacturers; and a concluding lecture on "Metallurgical aspects," by Mr. Rice.

Science Museum's Model Steelworks

Visitors to the Science Museum at South Kensington from January 24 will be able to see a working model of a complete steelworks. The model, which has been lent by the British Iron and Steel Federation, will be demonstrated and explained at intervals, and a selection of recent films on various aspects of the iron and steel industry will be shown.

On a floor area of 60 by 24 ft. the model portrays a steelworks covering a site of over a quarter of a square mile in area, with a weekly capacity of 10,000 tons.

The purpose of the model is educational. It is intended to show what a complete steelworks looks like and how the various pieces of steelmaking plant are arranged in process sequence from the iron ore to the finished product. Raw materials are unloaded at the docks by transporter crane and, with coke from the coke ovens, charged into the blast furnaces. There follow in sequence steelmaking furnaces, ingot-casting bays, soaking pits, and rolling mills. Ancillary services, such as a power station, repair shops, stockyards, 20 miniature locomotives, and 1,500 pieces of rolling stock running on half a mile of track, complete the scene.

The Science Museum is open on weekdays from 10 a.m. to 6 p.m., and on Sundays from 2.30 p.m. until 6 p.m. Admission is free.

A THIRD COURSE for managers in industry is being arranged by the University of Cambridge. It will be held in Madingley Hall from June 27-July 22, and will be open to managers who have some years' experience in industry and commerce and are under the age of 40. Firms can obtain details from Mr. G. F. Hickson, MA, Stuart House, Cambridge.

A BIG STEP FORWARD in the establishment of standardization in the basic dimensions and outputs of electric motors has been taken by Lancashire Dynamo & Crypto, Limited. This has been brought about by the company's introduction of a new A.A. (Anglo-American) range of protected-type and T.E. fan-cooled 50-cycle 3-phase motors in the one- to 30-h.p. range—a direct answer to the American action in revising their dimensions and ratings in this range after the American "NEMA" range had been established.

Pleas for Lower Taxation

Economists say that the financial position of a nation is not sound if taxation absorbs more than 25 per cent. of the national product. In Britain that absorption is now far more than 25 per cent., and a plea that we should strive to produce more and lighten our burden in this way was made by Mr. D. L. Walker, general secretary of the Federation of British Industries, at the annual meeting of FBI members in Scotland. He called upon the Government to adopt "wise saving and wise spending" in its fiscal policy to encourage investment in industry.

A warning that our capitalist system would be destroyed if taxation was not reduced was also given at the meeting by Mr. W. E. Luke, chairman of the FBI Scottish Council. If private enterprise was to continue to supply the economic lifeblood of the nation, he said, a way must be found to alleviate this burden. In the main, companies showed higher profits nowadays, but it had to be remembered that many of these had been ploughed back profits over the years, and it was only recently that boards had seen fit to pass some of these benefits to investors as dividends.

In a memorandum to the Chancellor of the Exchequer, the FBI urges that in the economic and financial circumstances now prevailing there is no need to retain the Capital Issues Committee in the operative form. Treasury consent through the CIC is still required where a firm's share capital is raised by more than £50,000 in any one year. The federation feels that such need as there now is to achieve the declared objects of capital issue control (determining an order of priority and avoidance of congestion in the capital market) "can be effectively met through the free working of existing financial institutions."

Sir HaHrry Pilkington, president, and some 60 other representatives of the Federation, have just had informal discussions on current economic problems with Mr. Butler. The Budget was excluded from the discussions, although fiscal matters were mentioned in general terms. The Chancellor is reported to have asked the FBI to impress on industrialists the importance of continuing plans for expansion of plant, and of further investment in modernization.

Chambers of Commerce Proposals

Cuts in a wide range of taxes and increased allowances are recommended to Mr. Butler, by the Association of British Chambers of Commerce. It is suggested that the Budget should aim to encourage more expenditure in industrial machinery and buildings and, it is said, there would be more will to do this "if a reduction in taxation reduced the odds a little to make it worthwhile."

The association also calls for a cut of one fifth in the purchase tax, a "radical revision" of the classes of the goods which should be charged, and a reduction in the petrol duty from 2s. 6d. to 2s. On profits tax the association urges that it be amended by converting the tax to a flat rate on company profits, whether distributed or not. The contingent liability to distribution charge on profits retained in prior years should be cancelled.

Eight suggested priorities for the Chancellor to incorporate in the Budget are contained in a memorandum which the Engineering Industries Association, representing about 3,500 firms, has sent to Mr. Butler. The suggestions include reduction of the standard rate of income tax; progressive reductions in purchase tax, leading to its abolition; reduction in petrol duty; profits tax adjustments; and retirement benefits for self-employed persons and directors of private companies.

Obituary

Dr. ERNST HOMBERGER, chairman of the Britannia Iron & Steel Works, Limited, Bedford, died in Switzerland on January 12 at the age of 85.

Mr. HENRY L. SIMPSON, assistant dockmaster at Northumberland Dock for the Tyne Improvement Commission, has died at the age of 57.

Mr. SYDNEY THOMPSON, who died on January 18 at the age of 80, was chairman of T. C. Thompson & Son, Limited, printers' engineers, of Manchester.

Mr. JOSEPH E. MARSHALL, managing director of the Langley Barony Fireclay Company until his retirement two years ago, has died at the age of 71.

THE DEATH occurred early in January of Mr. D. GOLDBERG, sales manager, Keith Blackman, Limited. He had been in the service of the company for 38 years.

Mr. CHARES EDWARD COX, who was for 40 years managing director of White Electrical Instrument Company, Limited, London, E.C.1, died recently in his 76th year.

Mr. JOE W. WHITEHOUSE, who for nearly 40 years had been employed by J. Birch & Sons, Limited, ironfounders, of Walsall (Staffs), where he was manager of the malleable-pipe-clip despatch department, has died at the age of 66.

Dr. GEORGE MARTIN LEES, FRS, chief geologist of the Anglo-Iranian Oil Company, Limited, from 1931 until his retirement in 1953, died last month at the age of 56. President of the Geological Society from 1951 to 1953, he was also a member of the Geological Survey Board and the Colonial Geological Survey Board.

THE AMERICAN technical Press reports the death of Mr. L. L. ANTHES, the only Canadian ever to preside over the American Foundrymen's Society. He was formerly the president of the Anthes Foundry, Toronto, a concern established by his father in 1894. During the 1914 war, Mr. Anthes commanded the 2nd Field Company, Canadian Engineers.

THE DEATH, at the age of 79 years is reported, of CHARLES BROADBENT PERKINS, who, prior to his retirement eight years ago was (for over 40 years) the representative in this country of the steelworks of George Fischer, Schaffhausen, Switzerland. From 1940 to 1950 he was associated with the malleable castings division of Britannia Iron & Steel Works, Limited, Bedford.

Mr. W. A. YOUNG, who joined the staff of the "Ironmonger" in 1900 and was editor from 1925 to 1934, died on Thursday, January 13, at the age of 87. He was a founder member of the Newcomen Society for the Study of the History of Engineering and Technology and was its president in 1938-39. Mr. Young was the author of "The Silver and Sheffield Plate Collector."

Mr. EDWARD TOWNSEND HIPPISLEY, manager of the traction (sales and engineering) department of the British Thomson-Houston Company, Limited, at Rugby, has died at the age of 61. After a three-year post graduate course with the company he entered the department in 1923. From 1929 he was responsible for heavy traction contracts involving electric and Diesel-electric locomotives, taking over the management of the department in 1936.

WILLIAM DENNY & BROS., LIMITED—Mr. Ernest D. Russell has retired from the board. Mr. David L. Nicolson has been appointed a director.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade, Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone CHAncery 4411, ext. 738 or 771), unless otherwise stated.

ASHFORD (KENT), February 12—Cast-iron manhole covers and street gullies for the year ending March 31, 1956, for the Urban District Council. The Surveyor, 5, North Street, Ashford.

BARNSLEY, February 14—Cast-iron manhole covers and gully gratings, for the 12 months ending March 31, 1956, for the Borough Council. The Borough Engineer and Surveyor, Town Hall, Barnsley.

BOLTON, February 4—Cast-iron gully grates and frames, gullies, manhole covers, and step irons for the year from April 1, 1955, to March 31, 1956, for the Borough Council. The Borough Engineer and Surveyor, Town Hall, Bolton.

HUDDERSFIELD, February 5—Cast-iron gully grates and manhole covers for the 12 months commencing April 1, 1955, for the Urban District Council of Colne Valley. The Council's Surveyor, Municipal Offices, Carr Lane, Slaithwaite, Huddersfield.

LONDON, E.C.1, February 10—Cast- and spun-iron straight pipes and specials, mild-steel bars, plates, sheets, etc., bolts and nuts, screws, files, and steel tubes, for the 12 months commencing April 1, 1955, for the Metropolitan Water Board. The Chief Engineer, Metropolitan Water Board, New River Head, Rosebery Avenue, E.C.1.

LOWESTOFT, February 14—Iron and steel for the period from April 1, 1955, to March 31, 1956, for the Borough Council. The Borough Engineer and Surveyor, Town Hall, Lowestoft.

MACCLESFIELD, February 19—Iron castings for the 12 months commencing April 1, 1955, for the Borough Council. Mr. J. H. Dossett, borough engineer, Town Hall, Macclesfield.

SLOUGH (BUCKS), February 14—Cast-iron manhole covers and frames, and gully grates and frames for the year from April 1, 1955, to March 31, 1956, for the Borough Council. Mr. E. Gardner Thorpe, borough engineer, Town Hall, Slough.

STOKE-ON-TRENT, February 7—Cast-iron work and cast-iron pipes and specials for the six months ending September 30, 1955, for the City Council. The City Surveyor, Town Hall, Stoke-on-Trent.

MALAYA, February 15—Brass stop taps, for Singapore Water Department. (ESB/1434/55.)

PAKISTAN, February 10—Diesel electric crane, fork lift truck, mobile cranes, etc., for the Deputy Director-General of Supply and Development, Chittagong. (ESB/1382/55.)

OSGOLDCROSS (YORKS), February 14—Ironwork, gully grates, manhole covers, etc., for the year ending March 31, 1956, for the Rural District Council. The Surveyor, Osgoldcross RDC, Tanshelf House, 15, Front Street, Pontefract.

SOUTH AFRICA, February 18—Stainless steel ware, for the Transvaal Provincial Administration. (ESB/952/55.)

TURTON (LANCS), February 24—Cast-iron gully grates and manhole covers for the year ending March 31, 1956, for the Urban District Council. Mr. Reginald Dart, engineer and surveyor, Council Offices, Bromley Cross, near Bolton.

Recent Wills

MANDAHL, A. E., iron and steel merchant, of Sheffield £74,369

PECKETT, FRANK, late chairman of Peckett & Sons, Limited, locomotive manufacturers, of Bristol ... £40,586

DAWSON, C. W., for many years an outstanding figure in south Yorkshire industry, and a former director of Newton Chambers & Company, Limited ... £185,994

WRIGHT, K. H., late a director of the Butterley Company, and of the Chesterfield Tube Company, Limited £2,797

HUTCHINSON, H. S., chairman of Douglas Elliot & Company, Limited, iron and steel stockholders, of Leeds £37,656

RIDELL, W. G., formerly chairman and managing director of John Hastie & Company, Limited, marine engineers, of Greenock £5,244

MANN, H. C., senior technical representative of the heavy construction department of Newton Chambers & Company, Limited £3,961

WILSON, P. H., deputy managing director of the Stanton Ironworks Company, Limited, and a past-president of the Institute of British Foundrymen £25,709

FERGUSON, PETER, chairman and managing director of Ferguson Bros. (Port Glasgow), Limited, shipbuilders and engineers, who was for some time chairman of Port Glasgow Harbour Trust £162,113

INTESTATE

LILLEY, M. E. B., late assistant managing director of W. S. Barron & Son, Limited, engineers and ironfounders, of Gloucester £6,103

Personal

Mr. WILFRID A. HARDY has taken up the appointment of secretary of Winston Electronics, Limited, Hampton Hill (Middx).

Mr. JAMES O'DOWD, Sheffield district organizer of the Iron and Steel Trades Confederation, has left the city to take up a position with a Glasgow company.

Mr. S. E. PARKHOUSE, chief of operating services (British Railways), British Transport Commission, retired at the end of last month after 49 years' railway service.

ADMIRAL THE EARL MOUNTBATTEN OF BURMA is to open the British Industries Fair at Olympia, London, on May 2. It will be the first official opening of the Fair in its 40 years' history.

Mr. GEORGE TALBOT has joined the staff of the Wellman Smith Owen Engineering Corporation, Limited, as general manager of the furnace building and contracting division of the company.

Prof. R. F. KAHN, who took over the Chair of Economics at Cambridge University in 1951, has been appointed to the research and planning division of the Economic Commission for Europe.

Mr. T. H. SUMMERSON, chairman of Thomas Summerson & Sons, Limited, railway plant engineers, etc., of Darlington, has been re-elected president of the Tees-side Industrial Development Board.

Mr. N. F. PATTERSON, a director and general manager of production of Monsanto Chemicals, Limited, has been appointed operations director responsible for all manufacturing operations of the company.

Mr. STANLEY J. HARLEY, chairman and managing director of the Coventry Gauge and Tool Company, Limited, has been elected president of the Coventry and District Engineering Employers' Association.

Mr. HERBERT REDGATE, president of the British Iron, Steel and Kindred Trades Association, has received a presentation to mark his year of office, which ended last month, and for his trade union work generally.

Dr. C. M. SCOTT has been appointed deputy head of the Industrial Hygiene Research Laboratory, near Welwyn (Herts), and has relinquished his membership of the board of Imperial Chemicals (Pharmaceuticals), Limited.

Mr. A. E. CARRODUS, sales director of Petters, Limited, oil-engine builders, of Staines (Middx), has left for a three months' tour of Africa. He is visiting some of the company's smaller installations in the heart of the continent.

Mr. ARTHUR STANLEY, who joined Charles H. Pugh, Limited, founders, etc., of Birmingham, in 1904 as a machine operator, and is now chief of stores, has received a presentation on completion of 50 years' service.

Mr. THOMAS MCIVER, who was appointed shipyard manager of Swan, Hunter & Wigham Richardson, Limited, at Wallsend six months ago, has been appointed general manager of the yard in succession to Mr. HAMISH LITHGOW, who has retired.

After more than 52 years' service, Mr. BRADBURY, commercial manager of the Staveley Iron and Chemical Company, Limited, has decided to retire on pension at January 31. He will be succeeded by Mr. J. D. BERRESFORD, deputy commercial manager.

Mr. R. H. SEMPLE, who has been regional manager in Scotland of British Insulated Callender's Cables, Limited, since 1952, has accepted an appointment with British Insulated Callender's Cables (Australia) Pty., Limited, and will leave for Sydney in March.

Mr. HERBERT CLARKE, works manager of Qualcast, Limited, Derby, has been elected president of the Derby and District Association of the Engineering and Allied Employers' National Federation, in succession to Mr. H. R. NEWMAN, general manager of the Butterley Company, Limited, Ripley.

The new president of the Sheffield Metallurgical Association is Mr. T. H. ARNOLD, who has been its hon. treasurer since 1944. Mr. Arnold, who was elected to his new office at the association's annual general meeting last month, is deputy controller of research with Hadfields, Limited.

Capt. H. LEIGHTON DAVIES, assistant managing director of the Steel Company of Wales, Limited, and a director of Richard Thomas & Baldwins, Limited, has been appointed chairman of the Welsh Board for Industry. He has been a member of the board since 1946 and vice-chairman since 1953.

Mr. F. B. DUNCAN, who has joined the boards of Ether, Limited, pyrometer and scientific manufacturers, etc., of Erdington, Birmingham, and of Electro Methods, Limited, electrical and scientific apparatus manufacturers, of London, N.W.11, has been appointed chairman of both companies.

Lord GRIDLEY was taken to Manchester Royal Infirmary after being taken ill while on his way to Stockport recently to attend the adoption of Mr. H. M. Steward as Conservative candidate in the Stockport South by-election. The by-election was caused by the elevation of Lord Gridley to the peerage in the New Year Honours. Lord Gridley, who was born in 1878, is chairman of Carrick Engineering (Stewarton), Limited, Mawdsleys, Limited, dynamo and motor manufacturers, of Dursley (Glos), and of other companies.

Among nine new members of the council of the Industrial Welfare Society are:—Mr. R. A. BANKS, personnel director of Imperial Chemical Industries, Limited; Lord BILSLAND, president of the Scottish Council (Development and Industry), and a director of Colvilles, Limited, and John Brown & Company, Limited; Sir FREDERICK JAMES, deputy chairman and managing director of Tata, Limited, iron and steel agents and exporters, of London, S.W.1; Sir HENRY SELF, deputy chairman of the British Electricity Authority; and the Earl of VERULAM, chairman of Enfield Rolling Mills, Limited.

The National Industrial Fuel Efficiency Service announces the appointment of Mr. H. H. GRATTIDGE as area engineer for Scotland in succession to Mr. J. EDWARD, to whom he was deputy. Mr. Edward, who is retiring because of indifferent health, has agreed to continue on a part-time basis in a consultative capacity. Mr. Grattidge trained at Newton Heath Technical School and Manchester College of Technology; after varied engineering experience he was appointed in 1948 to take charge of the Edinburgh office of the fuel efficiency branch of the Ministry of Fuel and Power. The new deputy area engineer for Scotland is Mr. W. SHORT, who joined the Ministry as a junior engineer in 1944.

News in Brief

A SHIPMENT of 9,600 tons of Russian iron and steel construction material—the first since the war—has arrived at Bombay.

PRIZES on Derby School "Speech Day," will be presented by Lord Hives, chairman of Rolls-Royce, Limited, at the Central Hall, Derby, on February 25.

BIRMINGHAM UNIVERSITY has received a grant of £2,000 a year for three years from Aero Research, Limited, for fundamental work on fluorine compounds.

A CONTRACT has been secured by the Imperial Smelting Corporation, Limited, to supply anhydrous hydrofluoric acid for the Atomic Energy Authority over the next two years.

THE LONDON OFFICE of Matthews & Yates, Limited, manufacturers of fans and equipment, of Manchester, has been transferred to 135, Rye Lane, Peckham, S.E.15 (telephone: NEW Cross 6571).

WOLVERHAMPTON AND DISTRICT PRODUCTIVITY COMMITTEE is staging a series of monthly film shows to encourage the productivity drive. The first, on January 25, was entitled "Production for Plenty."

A THREE-DAY residential study course on the use of statistics in personnel management is to be held in London early this month. Details are obtainable from the Institute of Personnel Management, 8, Hill Street, London, W.1.

COMPLETION is expected towards the end of next year of a contract to be undertaken at the Stockton-on-Tees works of Metropolitan-Vickers-Beyer-Peacock, Limited, to supply 40 110-ton, 3,600-h.p. electric locomotives for New South Wales.

IT IS ANNOUNCED by Crossley Premier Engines, Limited, of Sandiacre, that an order has been received from a well-known oil company for eight multi-cylinder horizontal oil-engines. This includes six engines each of 2,850 h.p. and two engines each of 1,300 h.p.

KODAK, LIMITED, announce that in March of this year nearly 8,000 employees will share a record bonus totalling approximately £414,000, the amount allocated to each being 2½ per cent. of his or her total wages received during the last five years. The Kodak wage dividend was first introduced in 1912.

A CLAIM by the Clerical and Administrative Workers' Union for a new salary scale for clerical workers in the engineering industry has been rejected by the Engineering and Allied Employers' National Federation. The federation has also rejected the claim by all unions representing 400,000 staff workers for a minimum of three weeks' holiday with pay.

AN ORDER worth nearly £1,000,000 has been received by the General Electric Company, Limited, from Johannesburg Municipality to supply for the Kelvin power station three 30-mw turbo-generator sets complete with feed-heating and evaporating plant. This brings the total number of sets on order or under construction for this station to six.

THE STAFF SOCIETY of Hadfields, Limited, steel founders, Tinsley, Sheffield, which was formed three months ago, held their inaugural dance at the Cutlers' Hall on January 21. There were more than 1,100 employees and friends present. Guests included Lord Dudley Gordon, chairman of the firm, and Lady Dudley Gordon, Mr. H. Humphries, managing director, and Mrs. Humphries.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, have given notice to between 40 and 50 of their employees that they are being discharged because of redundancy. Some of them finished work last week. The men affected include foremen, inspectors, and members of the administration staff. All three of the firm's works, two of which are at Springburn and one at Polmadie, are affected.

LICENCES to manufacture ferro-manganese have been issued by the Indian Government to Tata Iron & Steel, Jamshedpur, Bihar; Jaypore Mining Syndicate, Madras, for work at Razagada, Orissa; Indian Ferro-alloy, Gomharria, Bihar; Kambata Industries, Tumsar; and Madhyapradesh Electric Metallurgical Works, Bombay. The combined installed capacity will be about 105,000 tons a year.

IRON-ORE production in France last year increased from 42,443,000 tons in 1953 to 43,824,000 tons, representing an increase of about 3 per cent. Deliveries to consumers advanced to 42,427,000 tons from 40,850,000 tons. Exports of iron ore reached 11,215,000 tons, compared with 10,047,000 tons, the larger part of which (10,380,000 tons as against 9,041,000 tons) went to Belgium and Luxembourg.

ON JANUARY 21, the foundry operated by Henry Hollingdrake & Sons, Limited, Princess Street, Stockport, closed down after 140 years. The foundry was one of the oldest in Stockport and the surrounding districts. The engineering section of the company is to continue in operation until existing contracts have been completed. Foundry employees have obtained employment with other foundries in the district.

MR. T. M. MCKINLAY has joined Polygram Casting Company, Limited, as technical representative for the firm's shell-moulding equipment and will cover the north of England area. Mr. McKinlay, who during his apprenticeship as a patternmaker, was awarded an Archibald McInnes-Shaw Prize 1941 and John Surtees' Silver Medal in 1941, was previously employed by D. Napier & Son, Limited, Liverpool, on shell-moulding development work.

THE 9,000-TON Australian cruiser, Shropshire, which has been towed to Britain for breaking-up, has arrived in the Clyde, where it will be dismantled by W. H. Arnott, Young & Company, Limited, at Dalmuir. The vessel was diverted from Barrow-in-Furness, where pilots refused to dock it in darkness. British Iron & Steel Corporation, who bought the ship for scrap, said they could not wait till daylight and diverted the tow. Breaking-up has already started and the work will provide employment for a year.

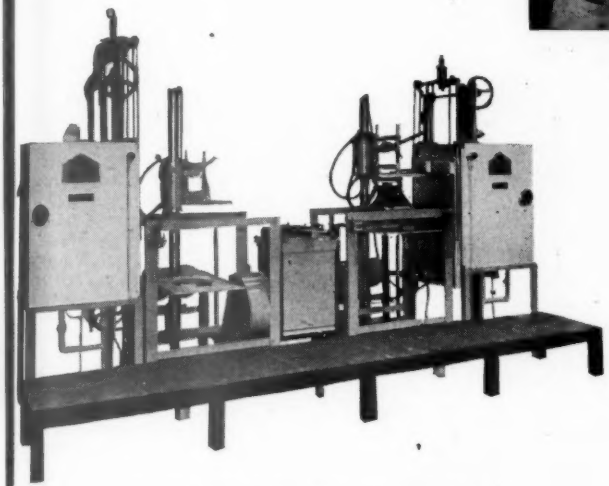
WORKERS employed by the North British Locomotive Company, Limited, Glasgow, have refused a request by the employers to consider a reduction of 10 per cent. in piece-work rates. The request was made because of the keen price the firm had to quote to win a recent contract for 25 locomotives—the first big order won by the firm for some time. In a reply from the men's representatives, the management were told the workers considered it would be inconsistent to agree to the reduction at a time when the engineering unions were negotiating for a wage increase of 15s. a week.

ON JANUARY 21, Mr. A. Watson, assistant managing director of Stanton Ironworks Company, Limited, near Nottingham, officially opened the enlarged and modernized office at Wapping Wharf, Gas Ferry Road, Bristol, 1 (telephone No. Bristol 24496). The stockyard here has been enlarged and reorganized to facilitate handling and despatching the company's products. Spun-iron pipes up to and including 12 in. dia. will be held

(*Continued on page* 134)

Shell Moulding in 3D

The Shelmolda 'Altus' will handle patterns up to 13in. in height or depth and therefore will provide a greater variety of sand/resin moulds than any other machine on the British market. All the main operations are carried out mechanically and the minimum of physical effort is required from the operator.



The Shelmolda "Altus" (patent applied for)

Shelmolda

Capacity

Effective pattern plate sizes of 16in. by 16in. and 16in. by 12in. Handles pattern plates 13in. high or 13in. deep in each oven. Will produce from split pattern 26in. overall. Oven opening adjustable up to 16in. above or below centre line.

Operation

Semi-automatic, with everything at all times under operator's full control. Oven doors, dump box and receptor pneumatically operated. Adjustable ejector mechanism. Investment time electronically controlled. Gas or electric ovens.

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FAIRBAIRN LAWSON COMBE BARBOUR LTD. LEEDS, ENGLAND. TELEPHONE: LEEDS 32041

AP 236-72

News in Brief

(*Continued from page* 132)

in stock together with a complete range of suitable special castings and flexible joints. Mr. H. Plummer is in charge of this warehouse.

"TO ENABLE us to compete with other world powers we must improve our technical knowldege," Sir Percy Mills told students of the Dudley Technical College at their annual prizegiving on January 21. "This country needs more managers and administrators with engineering backgrounds and industry looks to such colleges as this to supply the basic training," he added. Mr. P. J. Gibson, principal of the College, said that the total number of students had increased by more than 250 and the volume of work showed an increase of more than 100,000 student/hours.

THE FOUNDRY SECTION of the Federation of Swedish Mechanical Engineering Industries has suggested the establishment of a chair in foundry technique at the Stockholm Institute of Technology. It is stated that the high standards of inspection adopted in this industry result every year in the rejection of goods worth some kr. 40,000,000 by manufacturers, and it is thought that perfected manufacturing methods would lead to large-scale savings. Large sums are already being spent on this purpose and the creation of a special chair is to result in a further intensification of this work.

THE 24th annual presentation of awards to apprentices of Blackburn and General Aircraft, Limited, took place on January 24 at the Welfare Social Hall, Skillings Lane, Brough, Yorkshire. Mr. E. Turner, managing director, presided, and the 87 awards were presented by Sir Harry Garner, apprentice recruitment representative. Mr. N. E. Rowe, technical director, and Mr. T. A. Wolstenholme, apprentice supervisor, were also present. Mr. S. T. Smith won the directors' prize for the best all-round craft apprentice of the year. He works in the aircraft-engine machine-shop.

MIDLAND MANUFACTURERS and traders have been asked to accept week-end deliveries of goods from the railways in a statement issued jointly on January 25 by Mr. C. E. Jordan for the Birmingham Chamber of Commerce and Mr. R. P. Davis, district goods manager for British Railways in Birmingham. Every manufacturer and trader is asked to take "exceptional measures to unload and release wagons." Unless there is an improvement in the turn-round of wagons, there will be an adverse effect on industry, the statement adds. Birmingham Chamber of Commerce discussed the problem at its meeting on January 24.

DAVY & UNITED ENGINEERING COMPANY, LIMITED, Sheffield, have despatched the largest consignment ever from their works. It was comprised of five rolling-mill housings, each weighing 100 tons, for the works of Richard Thomas & Baldwins, Limited, Ebbw Vale, South Wales, and was part of a £5.000.000 contract for the firm's £12,000,000 development plan. The consignment made up the largest single load carried by the railways since the war and brought into service together the five biggest wagons of British Railways. These between them weighed 620 tons, and transport costs were about £10.000. Equipment weighing 1,400 tons has still to follow.

VICKERS-ARMSTRONGS, LIMITED, launched the 7.800-ton passenger cargo liner Demodocus for Alfred Holt and Company. Limited, Liverpool, at Walker-on-Tyne on January 24. Mr. C. D. Storrs, manager of Alfred Holt and Company said the Demodocus was 39 ships. There were three more to be delivered and the eleventh of 14 ships ordered by his company from Vickers-Armstrongs out of the post-war programme of when they had all been paid for the sum would amount to almost £15 million. He said Alfred Holt and Company hoped to make a further commitment shortly but it would not be right for him to say more than that he hoped Vickers-Armstrongs would be right in the price quoted.

THE NEED to replace brawn with brain in industry was discussed by Mr. David S. Anderson, director of the Royal Technical College, Glasgow, when he spoke at the annual dinner of Glasgow branch of the Former Students' Association of the College. Replying to the toast of the College, Dr. Anderson said he did not think people realized the extent to which manpower was being spread more and more thinly over the increasing number of activities demanded by modern civilization. One had only to think of the numbers engaged in amusement, entertainment, sport and travel to appreciate that the proportion engaged on real productive work was diminishing all the time. The effect of this could be counterbalanced only by a more widespread and a more intensive application of science in industry.

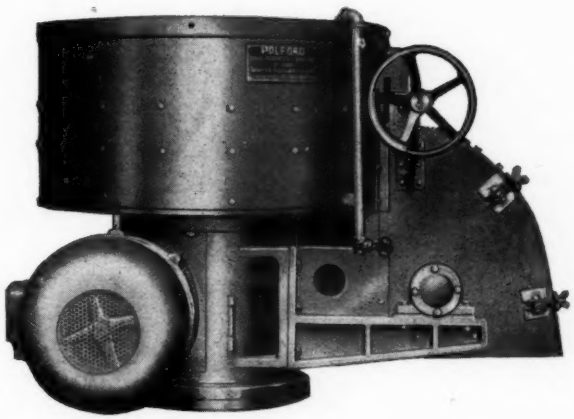
MR. S. C. TYRRELL and Mr. I. C. Kinloch, representatives of Newton, Chambers & Company, Limited, Thorncliffe works, Sheffield, are to make air tours of Africa in connection with the marketing of the firm's range of excavators. (Newton Chambers make excavators in three sizes, including a new half-yard machine, in association with an American company.) Mr. Tyrrell, who is assistant managing director of the company responsible for the excavator division, will carry out a tour in Rhodesia and South Africa which will cover 14,000 miles in 23 days. Mr. Kinloch, who is the excavator division's overseas representative, will carry out an air tour around Africa before April. Mr. I. S. Whiteman, sales manager of the excavator division, has just returned from a tour which included Yugoslavia, Greece and Turkey.

"ACTIVITY was intense in the scientific and technological fields, but not enough people were thinking from the human angle of the effect of developments on ordinary human life," said Mr. Leslie J. Clark, president of the Coventry Chamber of Commerce, when he spoke on January 21 at the annual dinner of the Coventry Junior Chamber of Commerce. He urged the need for more thought by the mass of the people. Mr. Clark, who was proposing the toast of "The Junior Chamber," said that its record was a remarkable one. It had produced many fine reports and such was the feeling of the senior Chamber that automatically difficult problems were referred to the junior body. Mr. Charles Johnson, president of the Junior Chamber, responded and said that theirs was the fastest-growing organization in the country.

MR. H. N. EDWARDS, managing director of Metropolitan-Cammell Carriage & Wagon Company, Limited, of Birmingham, commenting on the £750.000 order from the British Transport Commission for 600 bogie bolster wagons urgently needed for transporting long lengths of finished steel from the rolling mills, said on January 20: "The steel position is difficult. There is such a variety of sections needed to build wagons that we do not always get the right shape and size at the right time. Naturally, as the wagons are to help the steel mills, the steel people are doing all they can to help us." The mills are having difficulty in moving supplies of steel, particularly from the North-East Coast. Metropolitan-Cammell is coming to the end of a similar order placed in 1953 for 450 wagons of the same type. It is making deliveries at the rate of 20 wagons a week.

POLFORD FOUNDRY PLANT

MOTOR DRIVEN MIXER MILLER



Having a capacity of 3, 5 and 10 cwt. per batch, this machine provides an excellent medium for the mixing of facing sand, complete mixing and milling of which is achieved by means of a heavy duty, iron casting, three bladed impellor. Under average conditions, a batch can be thoroughly processed in two to three minutes; discharging time is normally less than one minute. The discharge door may be pneumatically operated; all working parts are fully protected. 'Brook' totally enclosed flange mounted motor, or belt drive.

Other models in the Polford range include: Vibratory screens, portable mould driers, vibratory shake outs, rotary driers, crucible furnaces, sand conditioning plant, etc.

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POL/7

Pig-iron and Steel Production

Statistical Summary of November Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the past six months. Table II gives production of steel ingots and castings in November, and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in November, 1954, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	All comdts.						Imports.[1]	Prod. ingots, castings.	Delivrs. finished steel.	stocks.[2]
1952[3] ..	254	329	323	206	190	228	202	171	29	310	252	683
1953	260	350	323	304	207	237	215	188	18	339	262	962
1954—June[4]	265	365	328	289	239	240	233	204	4	372	274	1,011
July ..	265	365	328	284	213	227	221	142	4	263	216	1,078
August	265	365	325	266	238	237	227	177	5	326	229	1,128
Sept.[4]	265	365	324	293	231	232	223	212	7	372	293	1,063
Oct. ..	265	365	324	304	237	236	231	210	3	374	292	973
Nov. ..	266	371	326	302	241	241	235	211	6	377	—	899

TABLE II.—*Production of Steel Ingots and Castings during November*, 1954.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.6	12.6 (basic)	1.8	0.2	17.2	1.0	18.2
Lancs. (excl. N.W. Coast), Denbighshire, Flints. and Cheshire	1.6	27.6	—	2.1	0.5	30.5	1.3	31.8
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	39.6	—	—	0.1	39.6	0.1	39.7
North-East Coast	2.4	69.8	—	1.3	0.4	72.1	1.8	73.9
Scotland	3.4	40.9	—	1.3	0.7	44.3	2.0	46.3
Staffs., Shrops., Worcs., and Warwick	—	17.7	—	1.2	0.7	17.6	2.0	19.6
South Wales and Monmouthshire	4.8	74.9	6.4 (basic)	1.3	0.2	86.8	0.8	87.6
Sheffield (incl. small quantity in Manchester) ..	8.3	33.5	—	10.8	0.5	51.0	2.1	53.1
North-West Coast	0.1	1.5	4.6 (acid)	0.5	0.1	6.7	0.1	6.8
Total	20.6	309.1	23.6	20.3	3.4	365.8	11.2	377.0
October, 1954	20.9	306.7	23.7	19.7	3.5	363.3	11.2	374.5
November, 1953	22.9	296.4	20.9	18.9	3.9	351.7	11.3	363.0

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1952.[3]	1953.	1953.	1954.	
			Oct.	Sept.[4]	Oct.
Non-alloy Steel:					
Ingots, blooms, billets and slabs[5]	4.5	4.7	5.4	5.2	5.4
Heavy rails ..	8.0	8.7	9.7	9.2	9.4
Sleepers, etc. ..	1.8	2.2	1.9	2.4	2.3
Plates, 3 mm. thick and over ..	41.4	46.5	49.1	49.3	49.3
Other rolled prod.	39.0	43.9	47.8	47.8	49.7
Wire rods and other rods, bars coiled	15.9	15.6	16.8	22.1	22.9
Light rolled prod.	46.0	49.3	51.5	51.4	53.8
Bright steel bars	6.5	6.7	6.8	6.9	7.2
Hot-rolled strip ..	18.8	18.8	20.1	24.2	24.4
Cold-rolled strip ..	6.1	5.2	5.9	7.6	7.3
Sheets incl. coated	31.7	34.1	36.6	41.3	40.8
Tin, terneplate and blackplate ..	16.0	14.9	17.9	17.5	17.2
Steel tubes, pipes	20.1	20.1	19.8	20.9	19.3
Tube, pipe fitgs.	0.4	0.3	0.4	0.4	0.4
Tyres, wheels, axles	3.5	4.4	4.7	5.1	5.1
Forgings (excl. drop forgings) ..	2.8	3.1	3.4	2.3	2.6
Steel castings ..	4.2	4.0	3.7	3.8	3.9
Tool and magnet steel	0.3	0.3	0.3	0.2	0.3
Total	267.0	282.8	301.8	317.6	321.3
Alloy steel	13.4	13.7	14.6	14.4	14.2
otal deliveries from U.K. prod.[6] ..	280.4	296.5	316.4	332.0	335.5
Add: imported finished steel ..	12.9	6.8	4.6	5.6	2.6
	293.3	303.3	321.0	337.6	338.1
Deduct: intra-industry conversion[7] ..	42.7	42.6	43.5	45.6	46.9
Total net deliveries of new material ..	250.6	260.7	277.5	292.0	291.2

TABLE IV.—*Production of Pig-iron and Ferro-alloys during November*, 1954.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total
Derby, Leics., Notts., Northants and Essex	26	—	21.0	23.6	0.8	—	45.4
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	7	—	17.4	—	—	0.9	18.3
Yorkshire (incl. Sheffield, excl. N.E. Coast)							
Lincolnshire ..	9	—	32.5	—	—	—	32.5
North-East Coast	22	4.5	48.0	—	—	1.4	53.9
Scotland ..	9	0.8	16.9	2.0	—	—	19.7
Staffs., Shrops., Worcs., and Warwick ..	6	—	7.4	1.4	—	—	8.8
S. Wales and Monmouthshire	9	5.3	33.7	—	—	—	39.0
North-West Coast	8	16.6	—	—	—	1.1	17.7
Total ..	96	27.2	176.9	27.0	0.8	3.4	235.3
October 1954 ..	96	26.7	173.4	26.9	0.4	3.3	230.7
November, 1953	107	27.1	167.3	29.5	0.9	3.7	228.5

[1] Weekly average of calendar month.
[2] Stocks mainly ingots and semi-finished at the end of the years and months shown.
[3] Average 53 weeks ended January 1953, all tables.
[4] Five weeks, all tables.
[5] Other than for conversion into any other form of finished steel listed.
[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
[7] Material for conversion into other products also listed in this table.

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3

Raw Material Markets

Iron and Steel

Full employment in the foundry trade is imposing heavy demands upon blast-furnace capacity. The squeeze is most severe in the case of low- and medium-phosphorus grades, which are extensively used in the production of engineering castings. But a much more active demand for high-phosphorus iron has also developed, and as supplies are inelastic, foundrymen are seeking bigger tonnages of cast-iron scrap. The output of basic iron is to be expanded as soon as possible; in the meantime, maximum tonnages are promptly absorbed.

Suspension of the import duties on steel semis has not solved the supply problems of the re-rollers. Continental makers have little material to offer, and are asking prices considerably in excess of the home maxima. Thus, deficiencies in the deliveries of billets, blooms, sheet bars, and slabs continue, while concrete bars and wire rods are in exceptional demand. There is scope for a considerable improvement in deliveries, and this improvement will have to develop quickly if short-time working of the mills is to be avoided.

Notwithstanding the steady increase in the outputs of the heavy rolling mills, demand continues to outstrip the supply and it is difficult to place an order with any absolute assurance of delivery within the next few months. The stockholders continue to render good service by supplying special sizes, but their stocks are now greatly depleted. The heaviest calls are for sheets and structural steel of all types and sizes, but light plates are not easily obtainable and there is a very keen demand for wire products.

Non-ferrous Metals

A firm tone characterized trading on the London Metal Exchange last week, gains being registered by all the metals. In the United States Anaconda advanced its selling price for copper to 33 cents, but the other producers held fast at 30 cents. The export quotation, however, advanced to 36 to 38 cents, f.a.s. In London trading in copper was active, the turnover on Friday being more than 2,000 tons, practically all of which was for three months or interim dates. On balance cash was up £14 on the week and three months £14 10s.

Higher prices are expected in view of the loss of output through the Rhodesian strike. The upward move was also influenced by the tense situation in the Far East, a factor which was responsible for an increase in the price of cash tin of £20 and in three months of £18. Zinc, for no obvious reason, was also strong, prompt adding £5 10s. to the previous Friday's close and forward £4 5s. The backwardation widened to £2 15s. High-grade brands are rather scarce, but g.o.b. metal is plentiful. The American quotation remained at 11¼ cents, so either London or New York is out of balance. Lead, also in plentiful supply, was up by £2 5s. and £1 15s. for the respective positions.

Statements have been issued by the Rhodesian copper producers on the vexed question of the special price plan. From these it would appear that the Rhokana group prefers to adhere to the principle of pricing on a free market basis. A suggestion is made, however, that the Metal Exchange contract should be reviewed again. The other important group on the copperbelt is apparently prepared to continue talks with the fabricators, who are facing considerable difficulties at present.

In New York, Copper Institute figures for December show US crude copper production at 97,800 short tons and refined at 133,500 tons, the latter being 17,400 tons up on November. Deliveries to consumers were 119,600 tons, an advance of 700 tons. Outside the US crude output was about 3,000 tons down, at 130,500 tons, while refined advanced by 2,100 tons to 108,600 tons. Deliveries were about 2,400 tons better at 109,600 tons.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* January 27, £312 10s. to £313; January 28, £312 to £313; January 31, £322 10s. to £324; February 1, £320 to £321; February 2, £326 10s. to £327 10s.

Three Months: January 27, £296 to £296 10s.; January 28, £296 10s. to £297; January 31, £303 to £304; February 1, £301 10s. to £302; February 2, £307 10s. to £308 10s.

TIN, Standard—*Cash:* January 27, £703 to £705; January 28, £705 to £705 10s.; January 31, £711 to £712; February 1, £713 to £714; February 2, £710 to £712.

Three Months: January 27, £706 to £707; January 28, £707 to £707 10s.; January 31, £712 to £713; February 1, £714 to £715; February 2, £711 to £712.

ZINC—*Second half January:* January 27, £88 5s. to £88 10s.; January 28, £89 15s. to £90 5s.; January 31, £91 10s. to £92. *First half February:* February 1, £90 to £90 10s.; February 2, £89 5s. to £89 15s.

Second half April: January 27, £86 10s. to £86 15s.; January 28, £87 10s. to £87 15s.; January 31, £88 15s. to £89. *First half May:* February 1, £88 15s. to £89; February 2, £87 5s. to £87 10s.

LEAD—*Second half January:* January 27, £103 15s. to £104; January 28, £104 10s. to £104 15s.; January 31, £105 5s. to £105 10s. *First half February:* February 1, £105 to £105 10s.; February 2, £104 15s. to £105.

Second half April: January 27, £103 10s. to £103 15s.; January 28, £104 5s. to £104 10s.; January 31, £105 to £105 5s. *First half May:* February 1, £105 to £105 10s.; February 2, £104.10s. to £104 15s.

Changes of Name

AMONG the companies which have recently changed their names are those listed below. The new titles are given in parentheses.

MIDLAND TUBE COMPANY, LTD., Rocky Lane, Aston, Birmingham (T. I. Plastics, Ltd.).

C. R. PURLEY, LTD., engineers, etc., of Shripney Road, Bognor Regis, Sussex (Evaporators, Ltd.).

SAFFRO ENGINEERING COMPANY, LIMITED, Burgess Road, Leicester (Burrows & Smith, Limited).

SLOUGH FOUNDRIES, LIMITED, Riverside Works, Standish Road, London, W.6 (Chambon Foundries, Limited).

JOHNSON BROS. (STEEL ERECTORS), LTD., 40, Brook Street, London, W.1 (Johnson Bros. (Closures), Ltd.).

SHAW'S MIDDLESBROUGH FOUNDRIES, LIMITED, 78/80, Cornhill, London, E.C.3 (W. Shaw & Company, Limited).

UNITED SCIENTIFIC INSTRUMENTS, LTD., Haymarket Court, 31/2, Haymarket, London, S.W.1 (B. Linden & Co., Ltd.).

CLAY CROSS COMPANY, LTD., colliery proprietors, etc., of Clay Cross, Chesterfield (Clay Cross Company (Holdings), Ltd.).

B.I.S.S. (METALS & RAGS), LTD., National Bank House, 101/3, Baker Street, London, W.1 (F. C. Larkinson (Lancashire), Ltd.).

PRELOAD (GREAT BRITAIN), LTD., manufacturers of prestressed structures, etc., of 5, Stanhope Gate, London, W.1 (Gilbert-Ash Structures, Ltd.).

PACKLESS GLAND COMPANY, LTD., scientific-instrument makers, general engineers, etc., of Teddington Works, Windmill Road, Sunbury-on-Thames, Middx (Teddington Refrigeration Controls, Ltd.).

AN INTERNATIONAL CONFERENCE on non-destructive testing of material is to be held in Brussels from May 23 to 28, 1955, under the auspices of the Association des Industriels de Belgique. Details are available from the Institute of Physics, 47, Belgrave Square, London, S.W.1.

Non-destructive Testing in Industry . . .

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Constant potential—up to 300 kV—results in a number of outstanding advantages. With this "M.300", by C. H. F. Müller, Hamburg, you are assured of: increased penetration; reduced exposure times; brighter, flicker-free fluoroscopy; reduced strain upon the H.T. cables.
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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

February 2, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 17s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 20s. 0d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £78 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £76 0s. 0d. to £78 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 8½d. per lb. Cr; 1 per cent. C,* 1s. 9d. per lb. Cr; 0.15 per cent. C,* 1s. 10½d. per lb. Cr; 0.10 per cent. C,* 1s. 10¾d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £54 15s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

* Average 68-70 per cent. Cr.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £54 10s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £326 10s. 0d. to £327 10s. 0d.; three months, £307 10s. 0d. to £308 10s. 0d.; settlement, £327 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, — per lb.; wire, — per cwt. basis; 20 s.w.g., — per cwt.

Tin.—Cash, £710 0s. 0d. to £712 0s. 0d.; three months, £711 0s. 0d. to £712 0s. 0d.; settlement, £712 0s. 0d.

Zinc.—First half February, £89 5s. 0d. to £89 15s. 0d.; first half May, £87 5s. 0d. to £87 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £122 5s. 0d.; rolled zinc (boiler plates), all English destinations, £120 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £98 0s. 0d.

Lead (Refined Pig).—First half February, £104 15s. 0d. to £105 0s. 0d.; first half May, £104 10s. 0d. to £104 15s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, — per lb.; rods, drawn, — ; sheets to 10 w.g., — per cwt.; wire, — ; rolled metal, — per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £199; B6 (85/15), £269; BS249, £225.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £239; HTB2 (30 tons), £248; HTB3 (48 tons), £262.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £260; LG3 (86/7/5/2), £268; G1 (88/10/2/½), £335; (88/10/2/1), £326.

Phosphor Bronze.—BS1400, PB1 (AID released), £353 per ton.

Phosphor Bronze Strip, etc.—Strip, — per cwt.; sheets to 10 w.g., — per cwt.; wire, — per lb.; rods, — ; tubes, — ; chill cast bars: solids —, cored — (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 9½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2¾d.; special quality turning rod, 10 per cent. ½ in. dia., in straight lengths, 4s. 1¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 10s. 0d. to £110 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £310; AB2, £318. Solder, brazing, BS1845, 2s. 4d. lb.; granulated, 2s. 7d. lb.